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Mobile Services Adoption Model

Thesis

MOBILE SERVICES ADOPTION MODEL

Doctoral Thesis

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ABSTRACT

This research presents an explanatory model for consumers' adoption of mobile services. This model uses the Unified Theory of Acceptance and Use of Technology presented by Venkatesh in 2003 as a baseline and integrates the Perceived Enjoyment, Mobile Affinity, Perceived Price of Service and the Frequency of Mobile Usage as to investigate the Attitude and the Intention to Use mobile services. The proposed model was empirically tested using data collected from a field survey where 1095 respondents filled out the two pages questionnaire. A structural equation modeling approach was used to test the proposed model and later to develop a refined version throughout an exploratory phase. This version proved to corroborate most of the model structure resulting from the exploratory phase. Different combinations of estimators and data scale properties have been used throughout the testing phases. The main findings indicate that all relations proved to be significant in the model except for the one between Effort Expectancy and the Intention. Still as expected the relation between the Effort Expectancy and the Performance Expectancy is the most influential in the model followed by the influence of Enjoyment on the Attitude. As expected, clear gender differences were found specifically when it comes to Social Influence. Another interesting observation is that the adoption theories stemming from developed markets performed well in an emerging market. Besides the methodological and empirical testing, this research furnishes a review of the information systems adoption theories and provides a detailed description of the players in the mobile commerce industry with an insight into the evolution of the value chains over the last 10 years. Besides the methodological importance for researchers, this study seizes a managerial guidance for the Mobile industry players who are interested in emerging markets.

ZUSAMMENFASSUNG

Diese Forschungsarbeit stellt ein Erklärungsmodell für die Verbraucherakzeptanz von mobilen Diensten vor. Das Modell verwendet als Ausgangsmodell die „Unified Theory of Acceptance and Use of Technology“, von Venkatesh et al. 2003, und erweitert dieses um „Perceived Enjoyment“, „Mobile Affinity“, „Perceived Price of Service“ und „Frequency of Mobile Usage“, um „Attitude“ und „Intention to Use“ von mobilen Services zu untersuchen. Das vorgeschlagene Modell wurde anhand von Daten einer Feldstudie empirisch überprüft, wobei 1095 Respondenten die beiden Fragebogenseiten beantworteten. Ein Strukturgleichungsmodellansatz wurde verwendet, um das vorgeschlagene Modell zu testen und dieses später in einer verfeinerten Version in Zuge der explorativen Phase weiter zu entwickeln. Der Großteil der Modellstruktur der explorativen Phase erwies sich als tauglich. Verschiedene Kombinationen von Schätzern und Skaleneigenschaften wurden während der Testphasen verwendet. Die wichtigsten Ergebnisse dieser Forschungsarbeit zeigen, dass alle Einflüsse im Modell signifikant waren, mit Ausnahme von „Effort Expectancy“ auf „Intention“. Wie erwartet ist die Wirkung von „Effort Expectancy“ auf „Performance Expectancy“ die einflussreichste im Modell, gefolgt von „Enjoyment“ auf „Attitude“. Wie angenommen wurden auch deutliche geschlechtsspezifische Unterschiede, speziell in Bezug auf „Social Influence“, gefunden. Eine weitere interessante Beobachtung ist, dass sich die „Adoption“-Theorien entwickelter Märkte als tauglich in aufstrebenden Märkten erweisen. Neben methodischen und empirischen Untersuchungen bietet diese Arbeit eine Überprüfung der „Adoption“-Theorien von Informationssystemen und liefert eine detaillierte Beschreibung der Mitstreiter in der Mobilfunkbranche, mit einem Einblick in die Entwicklung der Wertschöpfungsketten der letzten 10 Jahre. Neben der methodischen Bedeutung für Forscher, stellt diese Studie eine leitende Referenz für die Managementsicht der Mobilfunkbranche dar, welche an aufstrebenden Märkten interessiert sind.

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PART ONE: INTRODUCTION

THIS PART INTRODUCES THE DISSERTATION AND THE FIELD OF RESEARCH ALONG WITH RESEARCH QUESTIONS, PROBLEMS AND THE AIMS OF THIS DISSERTATION.

1 INTRODUCTION

This chapter introduces the dissertation and its research issues, it consists of two main parts, the first one starts by giving an overview and a snap shot of the mobile Phone and Mobile Commerce industries status, after that there is a short discussion on the research problem followed by the research design and the importance of this study before closing with the research questions and the aims of this dissertation. The second part presents the structure of this dissertation.

The number of people adopting mobile devices is surging globally; not only for the usage of traditional services like Voice; but for internet and other applications (Antero 2009). By October 2009, there were more than 4.3 billion mobile connections serving almost two thirds of earth population (GSM.ORG 2009) surpassing the sales of personal computers by 4 folds where penetration rates reached over 100% in more than 60 countries (GSM.ORG 2009). During 2009 and despite the financial downturn at the time, there was a remarkable 7.6% increase in the worldwide telecoms markets accounting for USD 2 trillion where 4 out of 5 dollars go to the telecom service providers (Gartner 2008; Cellular-news 2009); this trend is expected to hold according to the consulting company "Analysys Mason" they also expects a 6% compound annual growth rate to reach USD 2 trillion by 2013 where the Data Driven services will be the main driver of this growth growing at 131% (Cellular-news 2009); this trend is being seen now as the Smartphones; which are the foot soldiers for the data driven services; sales witnessed a phenomenal growth of 27% in the second quarter of 2009 (Gartner 2009).

This growth in adoption was accompanied by an extensive and remarkable development in the mobile network infrastructure. New wireless technologies like Worldwide Interoperability for Microwave Access (WiMAX) is emerging as an alternative to the current 2G and 3G network technologies , this is being clearly seen as the new mobile devices are supporting multiple network interfaces to allow smooth future integration. Meanwhile, the high speed packet access (HSPDA) is providing performance boost to the GSM and the UMTS

systems (Antero 2009; Wen, Hsien et al. 2009) and capitalizing on the current infrastructure. Still a new trend has been set through the “application store model” by Apple were the user bypassed the traditional network operator to gain access to the content of the store; thus reducing the potential revenue to be generated through data traffic over the cellular network (3GAmericas.org 2010) but still engaging in a Mobile Commerce activities over other mediums.

The growth of the social networking sites cannot be ignored when talking about Mobile Commerce; devices are being customized to be social network friendly. all the popular social network sites (facebook, MySpace, twitter, etc…) have mobile interface sites and applications tailored for the different mobile operating systems and platforms, the mobile adoption of these sites supported the uptake of data traffic and the sale of smartphones (3GAmericas.org 2010). In May 2010 facebook made a deal with more than 50 mobile operators around the globe to allow access to basic facebook features free of charge, mobile facebook users in may 2010 reported to be more than 100 million users (GSM.ORG 2010). It is becoming obvious that the trend is moving from being reachable any time anywhere to “being online and connected any time anywhere”.

This dissertation aims at proposing a model to explain and shed more light on the element effecting the adoption of Mobile Commerce services with particular focus on emerging markets.

1.1 Background Of The Problem And The Research Questions

Even though the penetration rate of Mobile communications is relatively low in the emerging markets compared to western Europe and south pacific regions, adoption rate of M-Commerce is still mediocre for many reasons mostly related to cost (Carlsson, Walden et al. 2006)

There are many new Mobile applications and advanced technologies available in these emerging Markets at the disposal of the consumer; but still adoption rate of M-Commerce is

low with an unexplored attitude towards the M-Commerce. Many theories stemming from psychology, consumer behavior, sociology, diffusion of innovation are being used to help understand the adoption process of the Mobile Commerce.

In Palestine, there is also an unidentified and unclear understanding of the M-Commerce adoption factors and processes. The empirical study of this dissertation will take place across the West Bank. Throughout this dissertation, the following questions are to be answered:

- What are the current drivers influencing the adoption of Mobile Commerce systems in general in an emerging market in and specifically in Palestine?
- What are the drivers of future intentions to use Mobile Commerce services?
- Are there differences between the drivers in an emerging market and a mature market? (comparing results to already conducted studies in Europe .i.e. Finland)
- To what extent can the proposed model explain the Mobile consumer intention to use Mobile Commerce / services?
- How and to what extent the relation between the "mobile and the user" influences the attitude towards adopting Mobile Commerce applications?

1.2 RESEARCH DESIGN

The research consists mainly of a quantitative research phase; an extensive literature review has been done in the domain of technology acceptance models and behavioral marketing among others. These were compared to the current practices in the field of Mobile Commerce research; from there a causal model has been developed; based on that model a data collection tool was developed where 1095 respondents filled a two pages questionnaire. This data will be treated through SPSS and later with Mplus to be used in testing the model.

The researcher decided to conduct an exploratory and confirmatory research phases, for this purpose the dataset collected will be split randomly into two halves, the first half to be used for testing the original model and to develop an exploratory research model, where the second half will be used to confirm the results from the exploratory model.

A comprehensive review of the Mobile Commerce value chain and its latest trends will be conducted, this will provide insight into the rapid and dynamic environment of the Mobile Commerce. Old linear value chain models will be reviewed along with the latest value networks proposed by the scholars in this field.

1.3 IMPORTANCE OF THE STUDY

As the current trend in pricing is moving towards the "Flat-Rate", "all-you-can-eat" plans break the link between traffic and revenue (Cellular-news 2009) , consumption of data driven services is seen as a crucial element for services providers as main contributor in profit making. This dissertation is of high importance to all the players along the M-Commerce and mobile telecommunications value chain. It will help identifying the main factors behind consumer adaptation of mobile data services.

Also, this dissertation will help the existing players in Palestine to be more informed about their current consumer's behavior and the trends in using Mobile Commerce, it will also help them in formulating strategic marketing plans.

In addition, this dissertation gives an overview of the Palestinian mobile users market where any new service provider, a content developer or their party content provider will be very interested in, as it gives insight into the market and help them in developing new applications and customizing the current ones to better suit the users.

On the theoretical level, this dissertation provides a model for "mobile service adoption", this models stems from earlier research in the fields of technology acceptance models, marketing behavior and many others. These models have been reviewed and modified to better fit the scope of the study.

On the methodological level, a comprehensive approach of handling categorical , interval and dichotomous data within Mplus is presented along with model estimation by way of different choices of estimators , also a rescaling approach based on the optimal scaling from the Gifi-family is being presented based on the work of (Mair 2009), this is used to validate the results from the exploratory and confirmatory phases above.

1.4 Research Questions and the Goals of this Thesis

The Mobile Commerce and its acceptance is becoming the main concern of Telecommunications companies in general and in the emerging markets in specific. The mass and rapid adoption of mobile devices is calling for more research in the field of Mobile Commerce in general and the acceptance of new Mobile Applications in specific. Taking the Palestinian market as an Example of an emerging market, the researcher will try in this dissertation to answer the following research questions:

1. What are the current Drivers influencing the adoption of Mobile Commerce systems in General in Palestine?
2. What are the drivers of future intentions to use Mobile Commerce services?
3. How and to what extent the relation between the "mobile and the user" influences the attitude towards adopting Mobile Commerce applications.

While answering these questions, the researcher will shed more light on the diverse strategies to be adopted for the Telecommunications companies in specific and all the players in the Mobile Commerce Value Chain in general. Any new player coming into the mobile telecommunications market will find in this dissertation a high relevance to its operations.

1.5 Structure Of The Dissertation

This dissertation is structured into five parts, where each of them is building and introducing to the next one. Below is a short description of what to expect in each part:

Part one, "The introduction" this part introduces the dissertation and the field of research along with research questions, problems and goals of the dissertation.

Part two, "The Mobile Commerce industry", this part consists of two main chapters, the first chapter is about the Mobile Commerce in general and the second chapter is about the

Mobile Commerce value chain where a thorough analysis is undertaken of each of the players along the value chain.

Part three, “the theory presentation” this part also consists of two main chapters, the first chapter is a general “Technology Acceptance” literature review with emphasis on Mobile Commerce. The second chapter presents the research model and the hypothesis development along with moderator’s effects.

Part four, “the empirical part”, this part constitutes four chapters, the first one concentrates on the operationlization of the constructs and the second one handles the data collection process from questioner design to actual collection process. The third chapter provides general analysis of the sample where the last chapter presents the testing phase, this final chapter is split into five main subchapters, the first presents the testing of the original model, the second presents the exploratory research phase, the third subchapter presents the confirmatory phase and the fourth subchapter presents a rescaling method to be used for model estimation, where the fifth and the last subchapter present the effects of the moderators.

The fifth part, this part presents the conclusion and findings of the study along with industry implications, research limitation and future implications.

The Reference listing and Appendices mark the end of this dissertation.

PART TWO:

MOBILE COMMERCE

THIS PART CONSISTS OF TWO MAIN CHAPTERS; THE FIRST CHAPTER PRESENTS THE MOBILE COMMERCE IN GENERAL WHERE THE SECOND CHAPTER INTRODUCES THE MOBILE COMMERCE VALUE CHAIN WHERE A THOROUGH ANALYSIS IS UNDERTAKEN FOR EACH OF THE PLAYERS ALONG THE VALUE CHAIN.

2 MOBILE COMMERCE MARKET AND PLAYERS

In this chapter a definition of M-Commerce will be given after a review of previous and related research, the drivers of the M-Commerce along with the enabling technologies will be presented and discussed.

2.1 WHAT IS M-COMMERCE

The latest breakthroughs in wireless technologies paved the road for a new kind of commerce; M-Commerce , where transactions are conducted through a wireless telecommunication networks, Mobile Commerce means different things to different people; to customers, it represents convenience, whilst merchants associate it with a huge earning potential and service providers view it as a large unexplored market (Keng Siau 2003).

2.1.1 M-COMMERCE DEFINITION

Due to the fact that the M-Commerce is a relatively new concept, there have been various recent attempts to give it a definition, earlier definitions were either emphasizing on the telematics; “M-Commerce is any transaction with a monetary value that is conducted via a mobile telecommunications network”(Müller-Veerse 2000) or emphasizing on the device; “M-Commerce is the buying and selling of goods and services, using wireless hand-held devices such as mobile telephones or personal data assistants (PDAs)”(UNCTAD 2002). Later on definitions foreseen the Mobile Commerce as a part (or a truncated version) of Electronic commerce like (Keen P. 2001) who defined M-Commerce as ”the extension of electronic commerce from wired to wireless computers and telecommunications, and from fixed locations to anytime, anywhere, and anyone device” or (Scornavacca Jr and Barnes 2004) who define M-Commerce as “the use of mobile information technologies, including wireless

Internet, for organizational communication and coordination, as well as management of the firm. “

The definition that will be used in this research is “Mobile Commerce refers to any commerce transaction, that is, involving either direct or indirect monetary value, conducted by using mobile devices via wireless communications”(Barnes 2002; Yang 2005). For the definition of a Mobile services the definition provided by (Bouwman, Carlsson et al. 2007) will be used ;”an activity or set of activities of intangible nature, which occur when the consumer is mobile, the activity or set of activities are supported by a mobile telecommunication provider who makes use of a combination of mobile and Internet networks, enabling activities between customers, and a provider of a service or a system supporting the service (Bouwman, Carlsson et al. 2007)

For further reference, below is a Table 1 showing other definitions for Mobile Commerce:

Table 1 - Definitions for Mobile Commerce

No.	Definitions of the M-Commerce in previous literature	Literature
1	Mobile Commerce, a subset of e-commerce, conducted through mobile devices using wireless telecommunications network is poised to change the market place globally.	Kini and Thanarithiporn (2004)
2	A commonly adopted definition, by Durlacher, defines Mobile Commerce as 'any transaction with a monetary value that is conducted via mobile telecommunication network'. Similar to e-commerce, the focus is on the exchange of products and services, but without the constraint of a stationary user using wired infrastructure	Camponovo and Pigneur (2003)
3	Giovanni Camponovo and Yves Pigneur prefer to adopt a broader view of mobile business, which includes 'all activities related to a (potential) commercial transaction through communications networks that interface with mobile devices'.	Tarasewich (2002)
4	Advances in wireless technology and mobile devices give rise to a new kind of e-commerce - Mobile Commerce. Mobile Commerce transactions are conducted via mobile devices using wireless telecommunication networks and other wired e-commerce technologies. Mobile Commerce (also increasingly known as M-Commerce or mobile e-commerce) enables wireless information exchanges and business transactions. Mobile Commerce means different things to different people. To customers, it represents convenience, whilst merchants associate it with a huge earning potential; and service providers view it as a large unexplored market.	Siau and Shen (2003)
	E-commerce is considered to be the buying and selling of information, products, and services via computer networks. A primary distinction between M-Commerce and e-commerce lies in the differences between transactions and access. M-Commerce provides good support and promotion for e-commerce transactions to roaming users, even if it is not always fully functional for every shopping need.	Stafford and Gilienson (2003)

Source: (Szu-Yuan, Ju et al. 2006)

2.1.2 THE MARKET DRIVERS FOR M-COMMERCE

The Mobile Commerce is still evolving and did not reach its peak yet, However, before that peak is reached, the following key market drivers are crucial to the growth of the M-Commerce market (Chang-tseh, Jones et al. 2008).

2.1.2.1 MASS MARKET MOBILE

High penetration and usage of mobile telecommunications services are prerequisites for development of the Mobile Commerce market. Latest figures show that more than 4.3 billion active connections at the moment where market penetration over 100% was reached in more than 60 countries(GSM.ORG 2009)

2.1.2.2 BOOMING WIRE LINE INTERNET

E-commerce is growing rapidly throughout the world, as more and more people are getting online, as of November 2009, 26% of the world population are using the internet (Anonymous 2009) and exposed to E-commerce. It is believed that with the highly personalized and truly anytime, anywhere access features of mobile telecommunication, reinforced by the increasing exposure to fixed-line e-commerce, the growth of M-Commerce will be much faster than fixed-line e-commerce(Chang-tseh, Jones et al. 2008).

2.1.2.3 SUPPLIER PUSH AND BREAKTHROUGH IN TECHNOLOGIES

It refers to the rapid pace of innovation in the mobile and internet industries, it is believed that a true uptake of M-Commerce will become a reality soon, when both equipment availability and functionality are more mature(Chang-tseh, Jones et al. 2008). At the moment there are 7 smartphones operating systems and 2 are planned to be launched in 2010 by Else and LG. these operating systems provide powerful support for Mobile Commerce (GSMarena 2009).

2.1.2.4 NETWORK LICENSING

The award of licenses for 3G, UMTS, 4G, etc. will play a critical part in the development of M-Commerce market. Licensing will determine the competition and the pace of development of the M-Commerce market(Chang-tseh, Jones et al. 2008).

2.1.3 THE ENABLING TECHNOLOGIES FOR M-COMMERCE

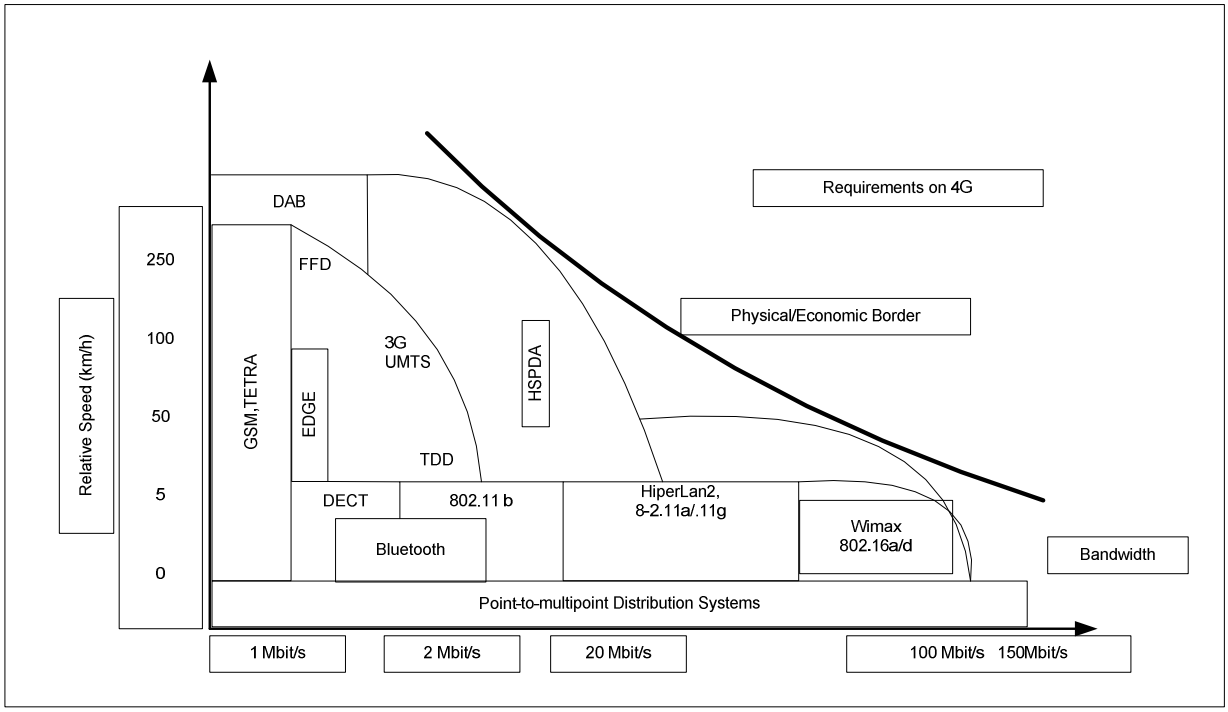
The growth of Mobile Commerce will depend on the development and deployment of enabling technologies (Keng Siau 2003). Such technologies are developed and distributed by Technology suppliers who are the key market drivers for M-Commerce (Chang-tseh, Jones et al. 2008). The recent developments of various technologies that enabled the fast data transmission over mobile networks were a key enabler of M-Commerce as we know it now. Mobile technologies can be categorized as follows:

1. Network Technologies
2. Service Technologies
3. Mobile Commerce Terminals
4. Security Technology
5. Mobile Location Technologies
6. I-mode
7. Other Wireless Technologies

2.1.3.1 NETWORK TECHNOLOGIES

A main barrier to M-Commerce is the limited network bandwidth and long calls establishment time. This limitation is slowly being eliminated as the mobile infrastructure is evolving from the analog (1G) to the digital (2G) then into the high-speed (3G and beyond) networks, below is a graph showing the various wireless access technologies including the Mobile technologies standards:

Figure 1 - Wireless Access Technologies (Adopted From Schiller, 2003, P.450)



Source: (Stephanie Teufel 2007)

The fast networks allow simultaneous access to voice, video and data services at once. Its packet-based IP nature also enables 'always on' mobility. This means that users can choose to be permanently logged on to e-mail, internet access and other services. The users are charged for how much information they send or receive, not charged for how long they are online (Amit Vyas 2001; Chang-tseh, Jones et al. 2008). Below is a Table 2 showing the mobile technologies and their key features:

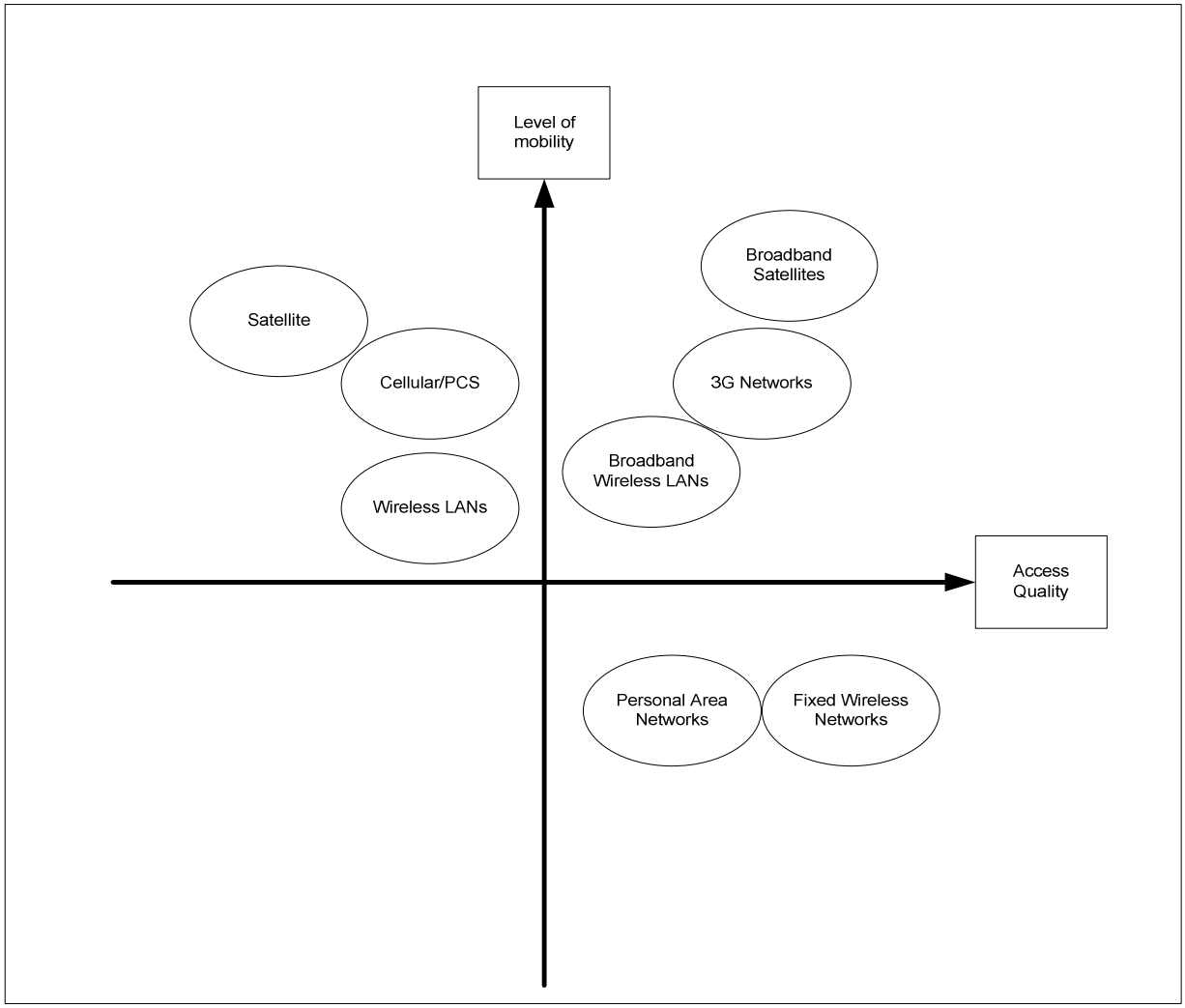
Table 2 - Mobile Technologies and Their Key Features

Generation	Access protocols	Data transfer speed	Key features	roaming
1G	FDMA	N/A	Analogue, primarily voice, less secure, support for low bit rate data	Access to and roaming across single type of analog wireless networks
2G and 2.5G	TDMA, CDMA	2G : 10-40 Kbps 2.5G : 20-171 Kbps	Digital, more secure, voice and data	2G: Access to and roaming across single type of digital wireless networks + access to 1G
3G	cdma2000 ,W-CDMA, HSPDA, TD-SCDMA		Digital, multimedia, global roaming across a single type of wireless network (e.g., cellular), 384 Kbps or higher (up to several Mbps)	3G: Access to and roaming across single type of multimedia wireless networks + access to 2G and 1G
4G	TBD	84 Mbps - 1Gps	Global roaming across multiple wireless networks, 50 Mbps or even higher, IP interoperability for seamless mobile internet	Access to and roaming across multiple types of high bandwidth multimedia wireless networks + access to 3G, 2G and 1G

Source: (Shim, Varshney et al. 2006; Sasha, Shim et al. 2007)

The Mobility is another issue at the M-Commerce market, the various wireless networks provide different mobility and different access quality levels, and this is best illustrated in the graph below:

Figure 2 - Mobility And Access Quality Levels



Source: (Sasha, Shim et al. 2007)

2.1.3.2 SERVICE TECHNOLOGIES

As the network capabilities improve, and as the mobile devices get better it is becoming possible to provide more data intensive services besides the traditional voice services. One of the most prominent ones are the Short Message Service(SMS) and the Wireless Application Protocol (WAP); these two services enable the majority of M-Commerce applications today, both of the SMS and WAP are mainly designed for low bandwidth 2G network. The high bandwidth 3G networks will spark a new generation of instant messaging and multimedia streaming services (Amit Vyas 2001; Chang-tseh, Jones et al. 2008). On the next page there is a listing for some mobile services technologies:

Table 3 - Mobile Technologies

Technology	Description
SMS (Short Message Service)	Allows text messages of up to 160 characters to be sent to and from mobile handsets via a store-and-forward system. Although a large proportion of this is based on person-to-person communication and voice mail, other services such as news, stock prices and SMS chat are growing in popularity. Around500 billion messages were sent in 2001.
MMS (Multimedia Message-Service)	This is a new messaging service supporting graphics and audio currently on trial in Europe. It plans to build on the success of SMS.
CB (Cell Broadcast)	Not to be confused with citizen's band (CB) radio; this is another text messaging service. However, unlike SMS, CB provides a one-to-many broadcast facility that is ideal for push-based information services such as news feeds.
SAT (SIM Application Toolkit)	This allows applications to be sent via CB or SMS in order to update SIM cards, e.g. for downloading ringing tones. Data security and integrity are standard features making it a popular choice for mobile banking. The WAP 2.0 standard will be compatible with SAT.
WAP (Wireless Application Protocol)	WAP is a universal standard for bringing Internet-based content and advanced value-added services to wireless devices such as phones and PDAs . In order to integrate as seamlessly as possible with the Web, WAP sites are hosted on Web servers and use the same transmission protocol as Web sites, that is hypertext transfer protocol (HTTP). The most important difference between Web and WAP sites is the application environment. Whereas a Web site is coded mainly using hypertext markup language (HTML), WAP sites use Wireless Markup Language (WML), based on extensible Markup Language (XML).
MExE (Mobile Station Application Execution Environment)	This standard is aimed at incorporating Java into the mobile phone and providing full application programming. MExE is compatible with WAP but incorporates many other sophisticated services including voice recognition and positioning technology.
J2ME (Java 2 Micro Edition)	A version of the Java language designed for small devices. This is somewhat similar to MExE.
iMode (information mode)	iMode uses a variant of HTML for the provision of Web pages. iMode enabled Web sites utilize pages that are written in compact HTML (cHTML) a subset of HTML 4.0 designed with regard to the restrictions of the wireless infrastructure.
iAppli (information application)	From January 2001, an upgraded version of iMode was provided in Japan to premium customers. The new service, iAppli, is based on Java. Applications can be downloaded and stored, thereby eliminating the need to continually connect to a Web site. Further, constantly changing information is automatically updated at set times, e.g. stock prices or weather forecasts
PDA Web Clipping	This technology allows popular PDA devices, such as Palm and Handspring, to access dynamic and updated HTML content via a modem. Web clipping is used in combination with applications stored on the device.
PDA Syncing	This allows PDAs to store or cache content without the use of a wireless modem. Content is updated when the user synchronizes ('syncs') or connects their PDA to the Internet via computer connection.

Source: (Barnes 2002)

2.1.3.3 MOBILE COMMERCE TERMINALS

Mobile devices are largely distinguished into four categories:

Mobile phone with voice only capability: these are becoming very rare; a good example is the Motorola startek.

Mobile phone with voice and basic connectivity: these mobiles are widely used; they can support Most of the M-Commerce applications available in the market.

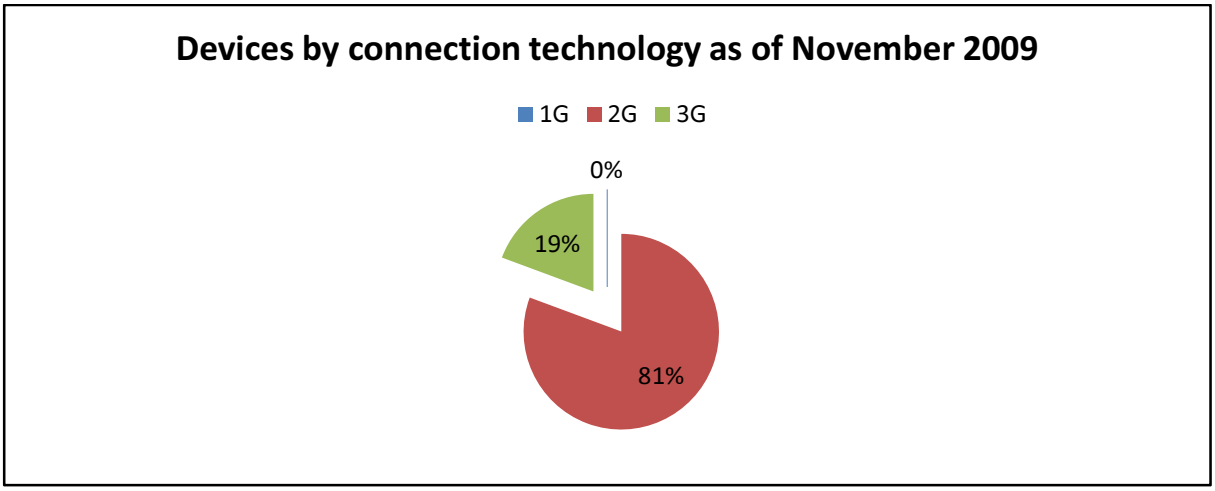
Smartphones: A mobile phone offering advanced capabilities, often with PC-like functionality(Best 2006) , a good example are the windows mobile powered devices, blackberry, Android and symbian powered devices.

Netbooks: this is the latest trend in mobile computing thanks to the low voltage processors technologies; these Netbooks have limited mobility due to the battery life that is much shorter than the mobile devices.

However, the borders between the categories are blurring. In addition to these devices, new smart phones are expected to be released that take full advantage of the technologies such as WAP, GPRS and UMTS. These devices will have larger displays and keyboards, a longer battery life, and advanced micro browser functionality. This technology will introduce mobile multimedia messaging and will enable users to download and listen to music, watch videos, remote control their household appliances, video conferencing and play interactive games(Chang-tseh, Jones et al. 2008).

Below Figure 3 is showing the distribution of devices in terms of connection technology:

Figure 3 - Mobile Devices By Connection Technology



Source: (GSM.ORG 2009)

2.1.3.4 SECURITY TECHNOLOGY

Security is a key enabling factor in M-Commerce. The market leader in security for M-Commerce is Sonera SmartTrust, who has offered Public Key Infrastructure (PKI) for cell phones since early 1999. The PKI is normally implemented on the SIM card without the smart phone. By means of certificates, certification authorities, asymmetric encryption and digital signatures(Chang-tseh, Jones et al. 2008).

As mentioned in the Mobile Commerce report from (Amit Vyas 2001); Full security is reached in PKI through:

1. Digital signatures for customer and merchant authentication
2. Non-repudiation of transaction involvement
3. Strong encryption
4. Message integrity
5. Confidentiality.

2.1.3.5 MOBILE LOCATION TECHNOLOGIES

The ability to locate the position of a mobile device is a key to provide geographically specific value-added information that stimulates M-Commerce. Global Positioning System (GPS) is one of the technologies that are embedded in some mobile devices and most of the Smartphones (Chang-tseh, Jones et al. 2008).

Location-based services (LBS) are based on the various distances of mobile communications from different base stations. With advances in automatic position sensing and wireless connectivity, the application range of mobile LBS is rapidly developing, particularly in the area of geographic, tourist, and local travel information systems (Peter Ibach 2005) Such systems can offer maps and other area-related information and can provide location-aware content to subscribers on the basis of the positioning capability of the wireless infrastructure. The LBS solutions can push location-dependent data to mobile users according to their interests, or the user can pull the required information by sending a request to a server that provides location-dependent information (Péter Hegedüs 2007) Mobile location technologies enable the distribution of highly valuable, localized information to mobile users. Applications include fleet management, vehicle tracking for security, tracking recovery in event of theft, telemetry, emergency services, location identification, navigation, location-based information services and location-based advertising(Chang-tseh, Jones et al. 2008).

2.1.3.6 I-MODE

I-mode (I stands for information) is a rival standard to WAP developed by Japan's NTTDoCoMo mobile phone networks that enables users to access Internet services via their cellular phones. It is widely used in Japan and has being introduced in Europe with no big success. I-mode uses compact HTML to deliver content. It makes it easier for businesses to convert their HTML website to mobile service. I-mode uses packet switching, which allows users to be constantly connected to the web and users can receive constantly broadcasted relevant information. It handles a significant amount of color graphics, a feature that is not available on WAP handsets. It also has wide range of online and often interactive services, such as mobile banking, news and stock updates, telephone directory service, restaurant

guide, ticket reservations, etc. Subscribers can also exchange e-mail with computers (Müller-Veerse 2000; Amit Vyas 2001; Chang-tseh, Jones et al. 2008)

2.1.3.7 OTHER WIRELESS TECHNOLOGIES

There are many wireless technologies that played and still playing an important role in enabling the M-Commerce , among these are the Infra-red, Bluetooth and Java (Amit Vyas 2001; Chang-tseh, Jones et al. 2008) but as technology is rapidly developing and evolving; Gartner research(Ginovsky 2009) has identified the Top 8 mobile technologies that will play major role in enabling the M-Commerce in the coming years:

1. Bluetooth 3.0 - This will include ultra-low-power enabling devices that will allow the rapid transfer of large volumes of data.
2. Mobile user interfaces - These will allow more accessibility for both business and customers.
3. Location sensing - The ability will enable contextual applications.
4. 802.lln - This standard will define Wi-Fi performance for years to come, offering performance on a par with the latest Ethernet wired connections
5. Display technologies - Active pixel displays, passive displays and pico projectors (instant presentations passed to desktop computers) will enhance presentations of data and video.
6. Mobile Web and widgets - These will provide low-cost ways to deliver simple applications to a range of devices, particularly those with small screens.
7. Cellular broadband - In many regions, this will provide adequate connectivity to replace WI-FI hot spots, while being incorporated directly into new laptops.
8. Near-field communications - This will provide a simple and secure way for handsets to communicate over very small distances, one example: mobile payments.

3 THE M-COMMERCE VALUE CHAIN

In this chapter, the Mobile Commerce value chain will be introduced and reviewed including the old and the new models. After that, a compression between the Mobile Commerce and the electronic commerce will be conducted followed by a discussion on the Mobile Commerce application types and functions.

3.1 INTRODUCTION

Since the introduction of M-Commerce some years ago, enterprises are becoming eager to include this technology in their day-to-day business activities capitalizing on the "reachable any time anywhere" concept and the ever-increasing need to be connected all the time. Due to the rapidly increasing interest in M-Commerce capabilities, many new players are taking part in the ever evolving M-Commerce value chain; earlier Value chain model from (Barnes 2002) analyzed the players, activities and technologies involved in the M-Commerce value chain based on the classical value chain analysis approach from (Porter and Millar 1985), this analysis proved to give a clearer understanding of the functions and the roles that each player holds; also (Müller-Veerse 2000) and (Barnett, Hodges et al. 2000) among others provided a value chain in their Mobile Commerce Report. Many models tried to provide value systems in the form of a chain or a web; in Table 4 below is a listing of the available value systems for the Mobile Commerce industry:

Table 4 - Value Systems For Mobile Commerce

Model	Distinctive features	Value creation configuration	Context of analysis
Alanen and Autio (2003)	Distinct value systems for the converged info-communications industry	Three distinct chains with linked layers	Analysis of value transfers in a network environment
Barnes (2002)	Based on the new media publishing value creation	Two parallel chains that jointly create value	Analysis of distinct and joint value creation features of content and infrastructure
Buellingen and Woerter (2004)	Functional and institutional views	Two-dimensional chain	Analysis of potential participants in each layer
Coursaris and Hassanein (2001)	Customer centric value web	Web	Analysis of value transfer to the consumer
Fransman (2002)	Joint value system for the converged info-communications industry	Chain	Analysis of any electronic information based industry
Li and Whalley (2002)	Shift from 'one to one' relationships to 'many to many' relationships	Web	Analysis of value transfers in a network environment
Maitland et al. (2002)	Converged value chain of 2G networks and internet services	Chain	Analysis of relationship between enablers and service providers
Olla and Patel (2002)	Introduction of new industry participant - Mobile Data Service Providers (MDSP)	Network	Analysis of the MDSP concept
Rulke et al. (2003)	Historical perspective; disintegration of layers	From chain to network	Analysis of industry dynamics
Sabat (2002)	Value creation is divided to the content side and to the network side	Two sequential value chains	Analysis of the link between the content layers and the network layers
Wirtz (2001)	Joint value system for converged industries	Chain	Analysis of integration of value added layers from distinct industries that

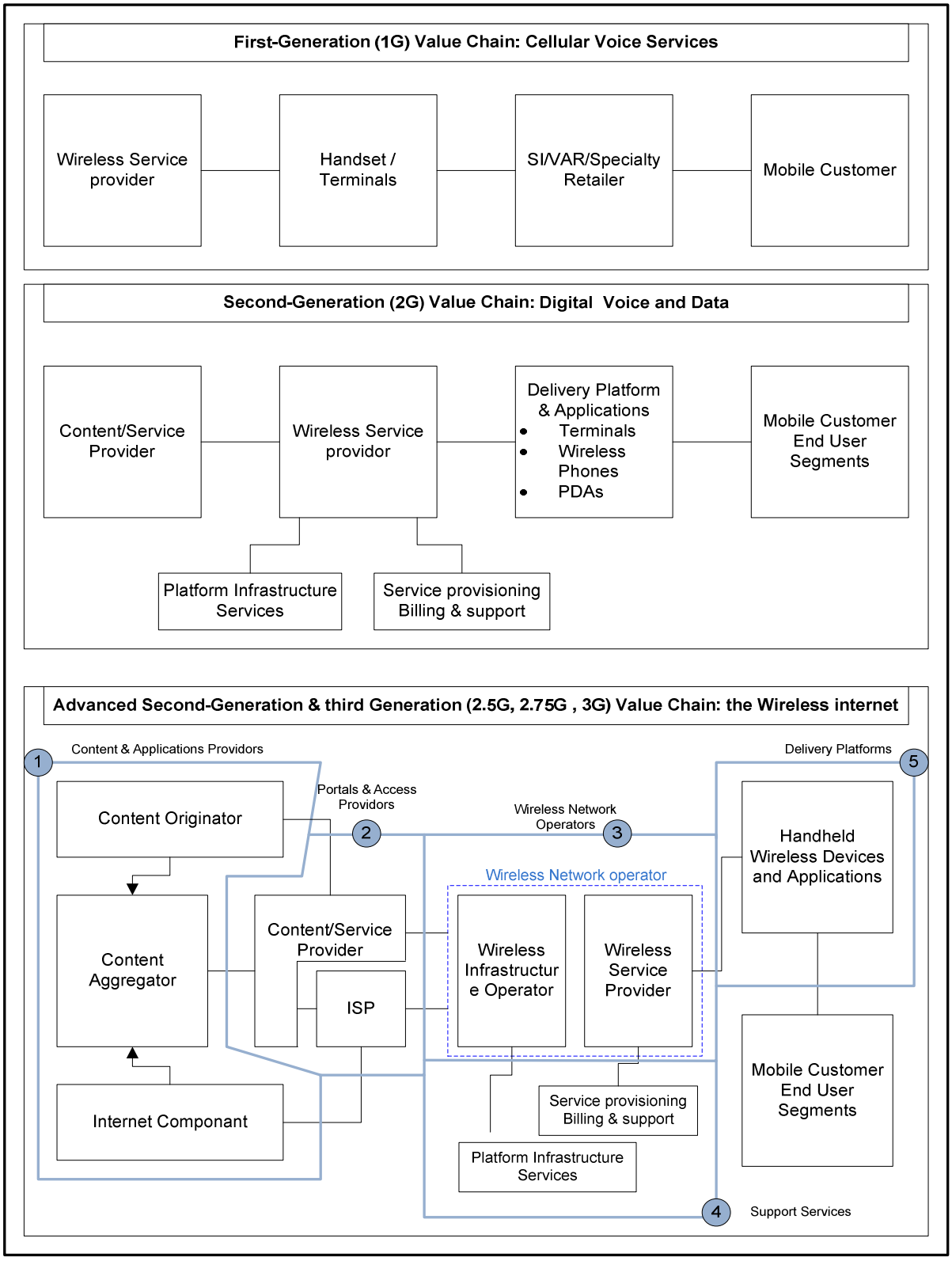
Source: (Turel and Yuan 2006)

In the last few years there has been some rapid development in the mobile technologies on both the network and the handset levels as well as on the way Mobile business is conducted;

this proved to complicate the M-Commerce Value chain; and by only analyzing the linear value chain, the company, its suppliers, and customers, and also its complementors and competitors makes it hard get the whole picture of what is really going on in the M-Commerce environment, a value chain as described by (Porter and Millar 1985) is appropriate for representing manufacturing industries in which the transformation of physical materials through a sequence of manufacturing processes is the critical feature of these industries and the major source of competitive advantage for many of the firms in these industries (Funk 2009) where the concept of ValueWeb or a value network are more appropriate for industries in which a firm's internal processes are less important than the multiple ways in which firms and customers are connected to each other. Such industries include banking, insurance, advertising (Ramirez 1994)and of course the Internet. In these industries value is co-created by a combination of players in the Network and this is becoming the case in the M-Commerce environment, this value is co-produced by network of organizations and that is where the competition is fierce (Peppard and Rylander 2006), Using a value Network can give a better understanding of the M-Commerce business environment (Funk 2009).

The value chains / networks have changed along with the technological evolution of the mobile standards, but always the network operator possessed a central or the gatekeeper role in this process. Also new players were joining the Value creation process; this evolution is best described by Figure 4 below:

Figure 4 - Mobile Commerce Value Chain Evolution

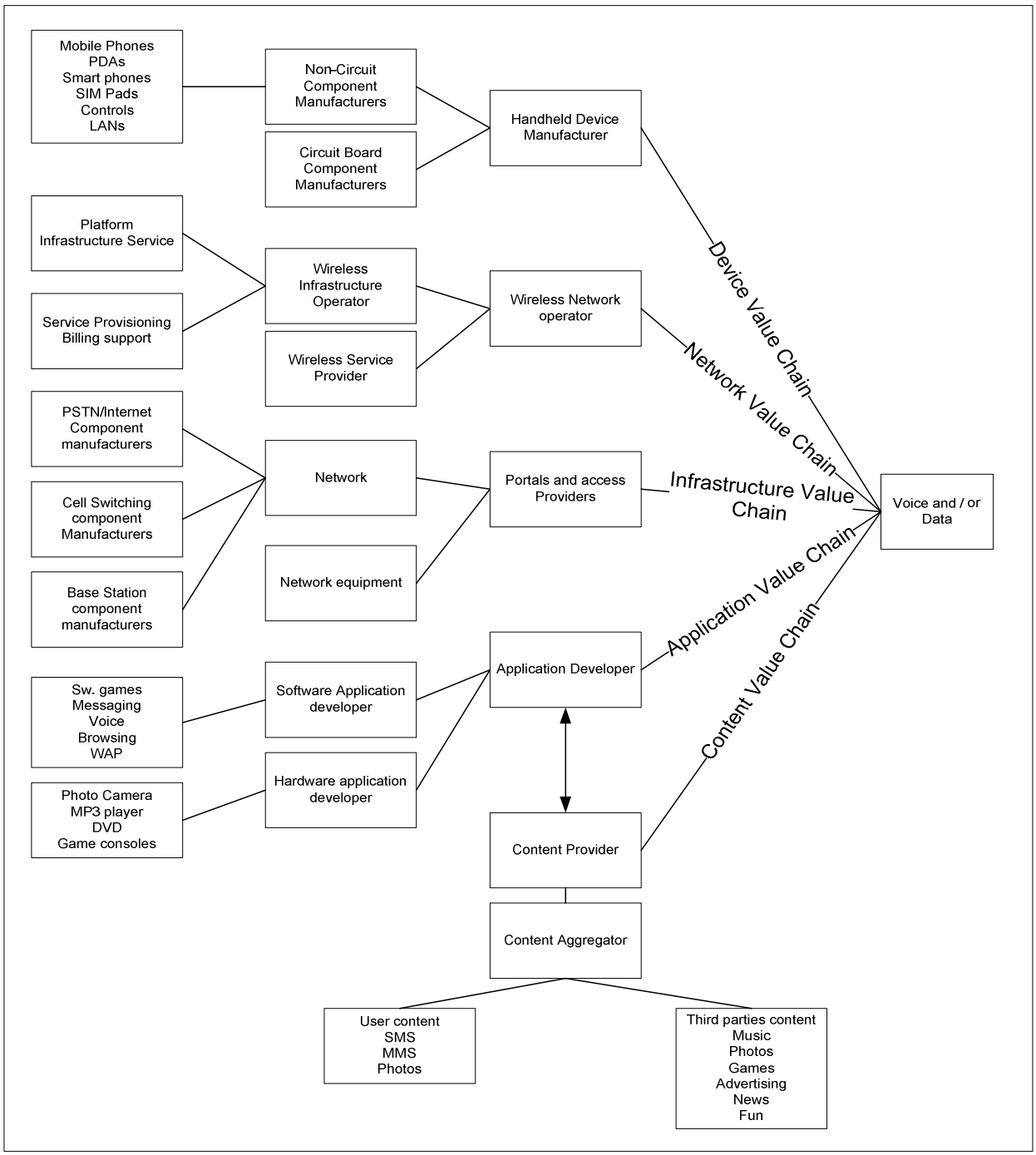


Source: (Andreas Rülke 2003)

The network structure presented by (Pagani and Fine 2008) gives a very comprehensive outlook for the Wireless Network structure with emphasis on the current technologies and

the upcoming ones tackling it using five supply chains; the Device Value Chain, the Network Value Chain ,the Infrastructure Value Chain, the Application Value Chain and the Content Value Chain, this Network structure can be seen in Figure 5 on the next page; is very useful for in-detail strategic analysis of the M-Commerce chain which is not the purpose of this research.

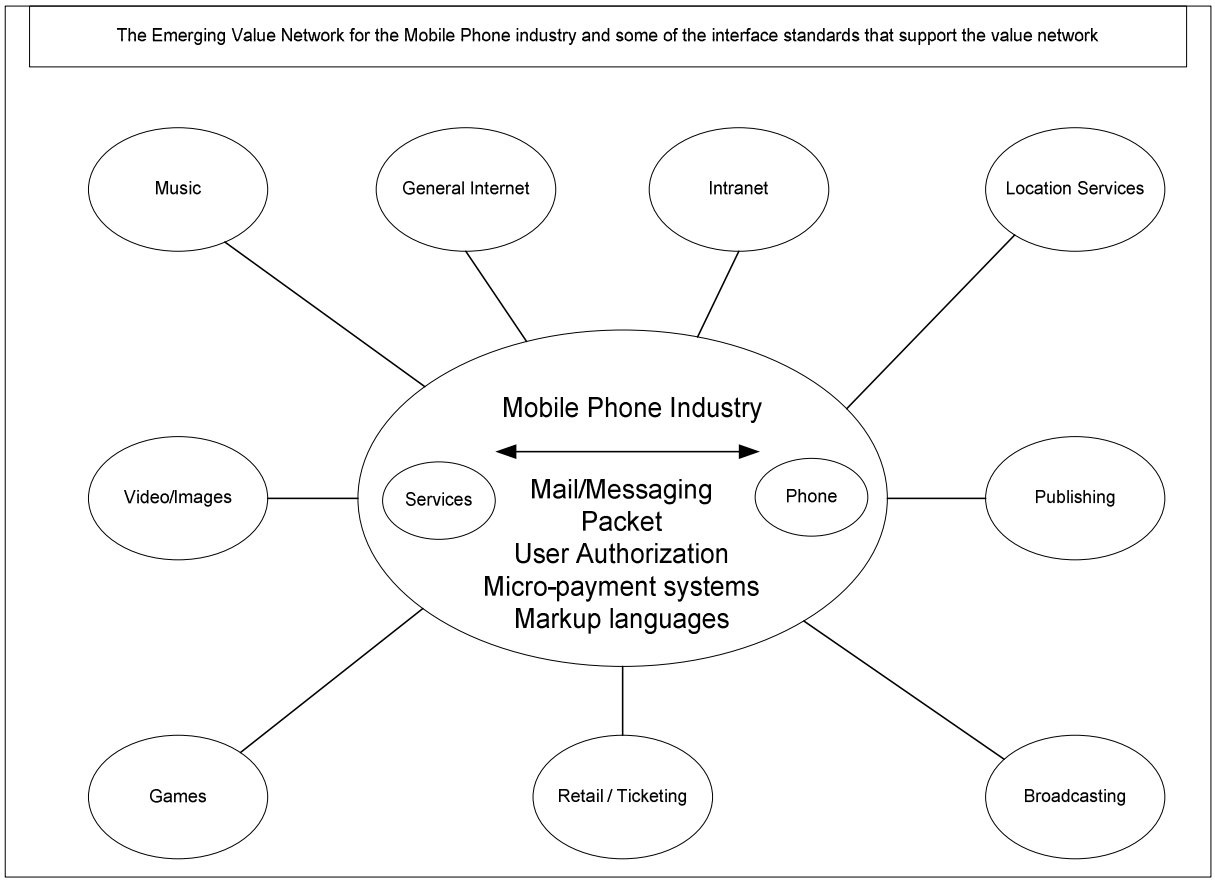
Figure 5 - Wireless Value Network Structure



Source: (Pagani and Fine 2008)

Also another approach toward the analysis of the M-Commerce value network concentrates on the actual values created and not on the players who create them; this was best represented by (Funk 2009) where he identified 9 sectors where value is created , this is illustrated in Figure 6:

Figure 6 - The Emerging Value Network For The Mobile Phone Industry



Source: (Funk 2009)

Though Another Model presented by (Kuo and Yu 2006) gives a more specific and clearer vision of the actual players and their roles in the M-Commerce value chain referring to both (Müller-Veerse 2000; Barnes 2002)

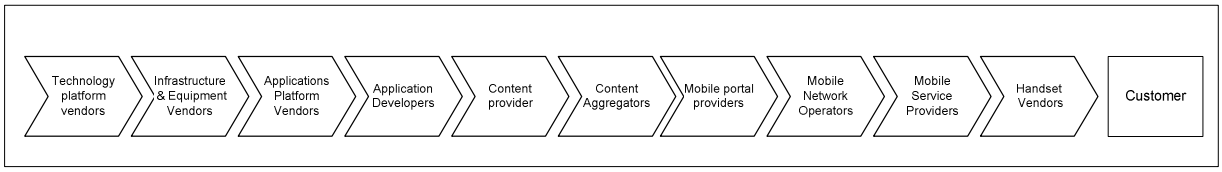
The following subsections, will shed some light on the old M-Commerce value chain presented by (Peppard and Rylander 2006) and later the new Value network presented by (Kuo and Yu 2006) will be presented and analyzed in detail to shed more light on the actual situation and players in the M-Commerce world.

3.2 EARLIER VALUE CHAIN MODELS

The (Müller-Veerse 2000) Model was from the very first models trying to analyze the M-Commerce Value chain, it presented a liner approach towards the M-Commerce Value chain analysis assuming that value is accumulated through the Value chain until it reaches the end user.

This chain analysis provided a clear approach towards the players and their roles in the M-Commerce industry in general and value creation in specific. These players are still in the current Mobile Commerce value chains/networks but their relation among each other and their roles in the value creation has changed as illustrated in the coming subsections. Below is the (Müller-Veerse 2000) value chain as presented in the "Mobile Commerce Report" around 10 years ago:

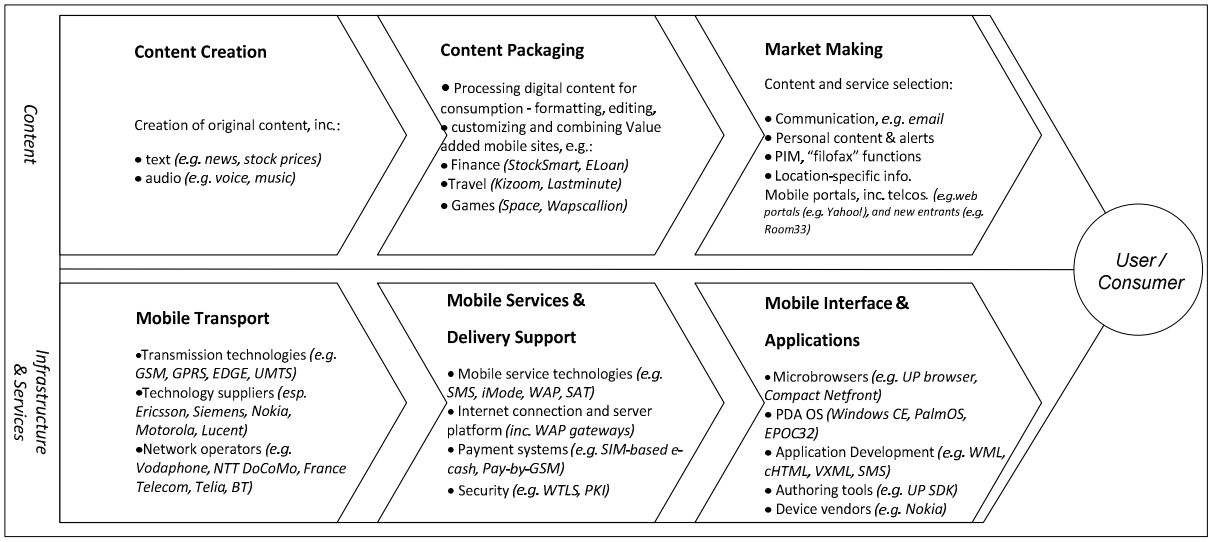
Figure 7 - The Mobile Commerce Value Chain



source : (Müller-Veerse 2000)

A later model presented by (Barnes 2002) splits the Value Chain into two dimensions, the Infrastructure and services Dimension and the content Dimension. This Value chain became very famous in the M-Commerce research and was adopted by many researchers. Each of the two main dimensions in this chain consists of three consecutive process accumulating value along the chain, which will eventually lead towards the creation of value to the end user. This is considered as an evolution of the (Müller-Veerse 2000) value chain where it grouped different players under process with emphasis on the creation of "new media" This Chain is presented in Figure 8 below:

Figure 8 - The M-Commerce Value Chain



Source : The M-Commerce Value Chain(Barnes 2002)

Both of the above mentioned Models were considered when Developing many models including the (Kuo and Yu 2006) Model that will be used to identify Bold lines of the Mobile Commerce market players and their major roles.

3.3 THE MARKET PLAYERS -VALUE NETWORK ANALYSIS APPROACH

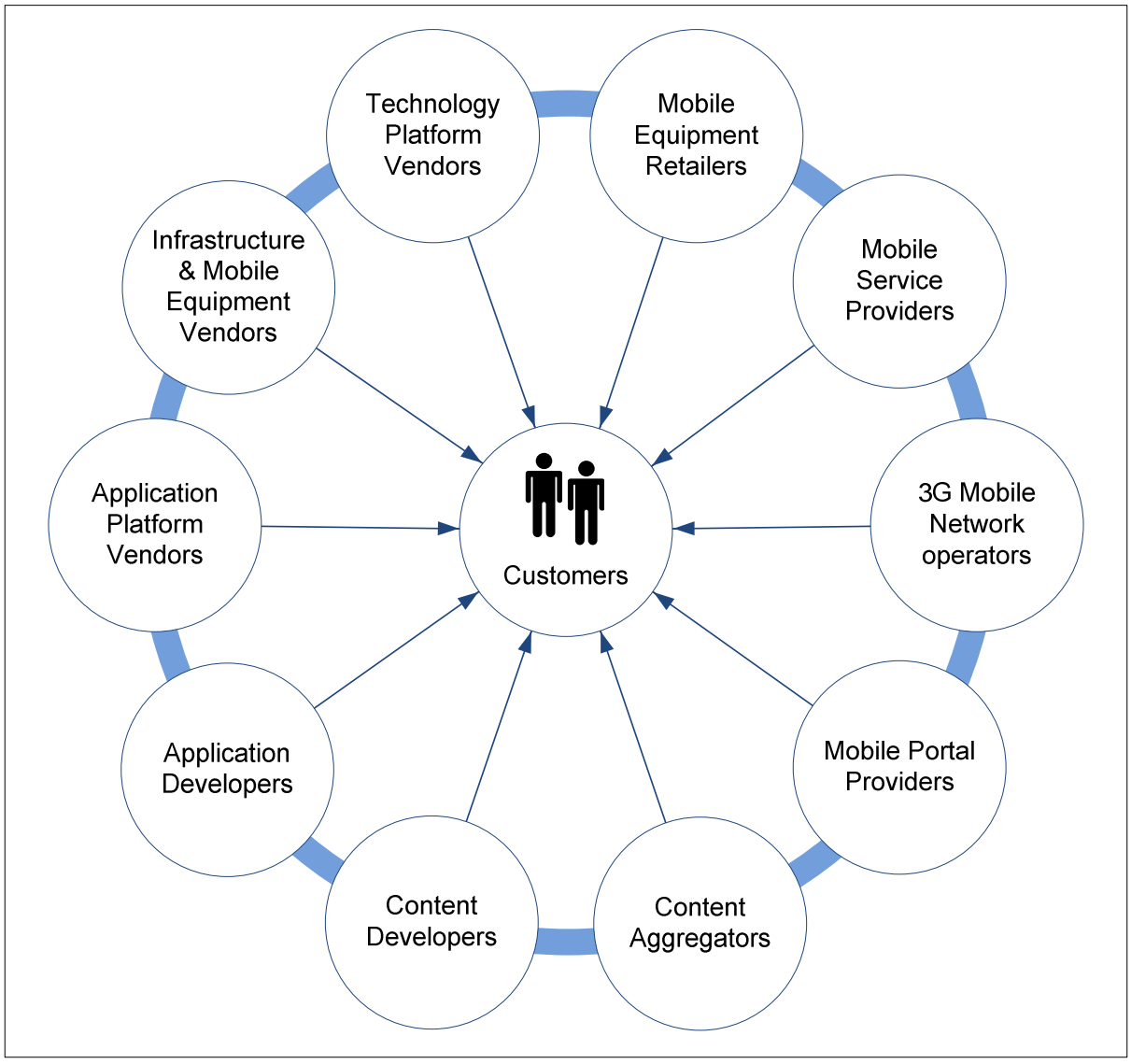
3.3.1 INTRODUCTION

As Porter mentioned, the Value chain is the linkage and integration of a series of activities in which enterprises deliver the created and valued products or services to customers (Porter and Millar 1985) and Mobile Commerce is similar to other products or services. The process of linking additional values to the end users also involves many value providers (Barnes 2002). So far, there is still no conclusion regarding the participating roles and names of the Mobile Commerce value chain (Kuo and Yu 2006) as the M-Commerce industry is moving from a Value chain to a Value network, until recently the structure of the M-Commerce industry could best be described in terms of two relatively independent value chains for

phone manufacturers and operators. With the addition of Internet compatibility and other functions, however, the structure of the mobile phone industry is gradually changing to a value network in which firms from a broad set of industries are interacting in the supply of a broad range of mobile Internet-related services(Funk 2009)

For the purpose of this research and understanding the players in the M-Commerce industry, an analysis of the Value net proposed by (Kuo and Yu 2006) will be used to identify the classical market players and group them in more General segmentation of the market presented by (Chang-tseh, Jones et al. 2008) since many players can join these groups as the market changes.

Figure 9 - The Mobile Commerce Value Chain



Source : (Kuo and Yu 2006)

This chain is very similar in content to the two models presented earlier, with the difference in the relationship between the players and the actual interaction towards the value creation. It also reflects the current Mobile Commerce players:

3.3.2 The Market Players

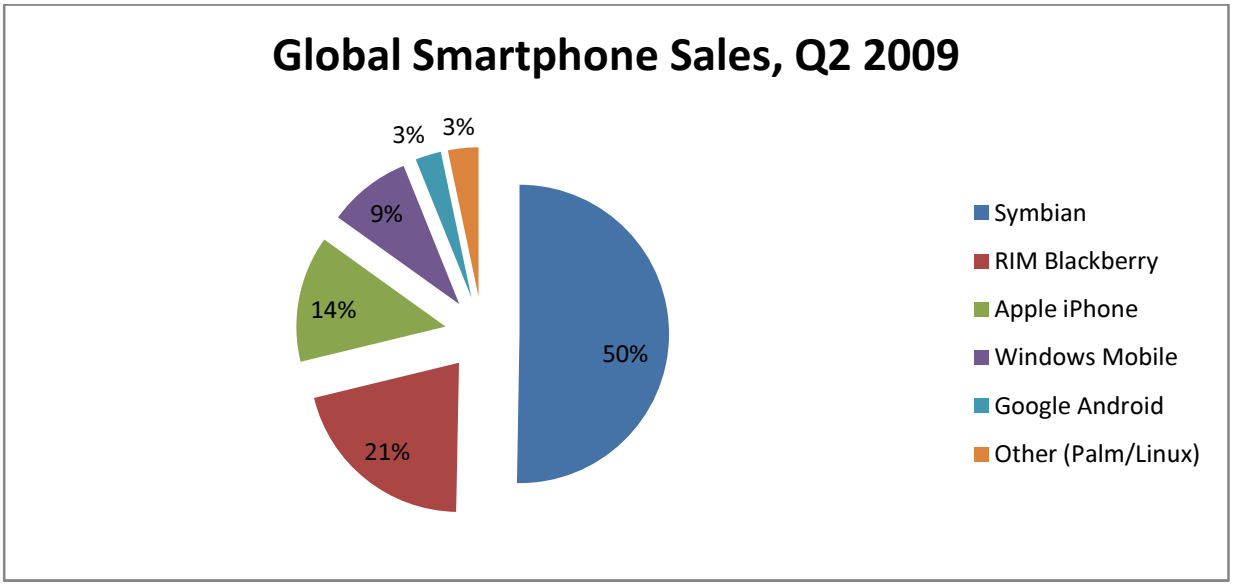
As mentioned earlier, due to the rapidly changing M-Commerce dynamics there are many players joining the Value chain every day, referring to research by (Chang-tseh, Jones et al. 2008) they suggested to group the market player into 4 main categories, the technology developers, the technology application developer, the service providers, and the consumers.

3.3.2.1 The Technology Developers:

3.3.2.1.1 Technology Platform Venders:

Technology platform vendors deliver the operating systems and micro browsers for mobile devices such as smart phones and other communicators (Chang-tseh, Jones et al. 2008).

Figure 10 - Global Smartphone Sales



Source : (Canalys 2009)

As illustrated in Figure 10 above, the dominant operating system in the symbian accounting for more than 50% of the smartphones available followed by the RIM blackberry with 21% (Canalys 2009).

These operating systems come usually packed with office applications, internet browser and a multimedia player among many other applications, a key player in the browser business is Opera.

3.3.2.1.2 INFRASTRUCTURE EQUIPMENT VENDORS.

Infrastructure equipment vendors design, develop and manufacture the mobile network infrastructure equipments required to build a mobile communication networks (Kuo and Yu 2006; Chang-tseh, Jones et al. 2008). Also the Infrastructure equipment vendors play an important role of promoting the latest innovations of the industry and the technology (Müller-Veerse 2000).

In 2008, The major supplier was still L.M Ericsson despite the giant ”Nokia Siemens Networks” which was created by a joint venture between the two largest telecommunications equipment suppliers in the world, other players include Lucent, Motorola and Ericsson and the promising Chinese company Huawei (Müller-Veerse 2000; Kuo and Yu 2006; Dell'Oro-Group 2008) all of these companies have been developing and marketing solutions for mobile data and mobile internet. The market distribution below in Table 5 shows the market share of each as of the first quarter 2008

Table 5 - Mobile Infrastructure Vendors

Mobile Infrastructure Vendors (All technologies)	
Vendor	**1Q 2008 Market share**
L.M. Ericsson	32.60%
Nokia Siemens Networks	23.90%
Alcatel-Lucent	15.70%
Huawei	8.20%
Nortel Networks	8.00%
Motorola	5.40%
ZTE	3.50%

Source : (Dell'Oro-Group 2008)

3.3.2.2 TECHNOLOGY APPLICATION DEVELOPERS

3.3.2.2.1 APPLICATION PLATFORM VENDORS.

A particular key driver for providing wireless internet applications is the availability of middleware infrastructure, i.e. the WAP gateways either at the mobile operator's site or at the corporate customer's site. Application platform vendors are those companies who develop these WAP gateways like Nokia and Ericsson (Chang-tseh, Jones et al. 2008).

In order to drive the industry and to formulate standards, the following interest groups have been formed: the WAP Forum, the Mobile Data Initiative, Bluetooth Special Interest Group and the UMTS (Universal Mobile Telecommunications System) Forum. These groups set de facto standards by assembling the key players and agreeing to workable development conditions much faster than the traditional standard bodies(Ling, Chou et al. 2005)

3.3.2.2.2 APPLICATION DEVELOPERS.

Application developers are companies who develop applications for the mobile environment. At present, most of these applications are built around the leading mobile operating systems mentioned in the previous section above.

3.3.2.3 SERVICE PROVIDERS

3.3.2.3.1 CONTENT PROVIDERS.

Technologically advanced content providers are also moving into mobile space to be ready for M-Commerce. The mobile network is a new distribution channel for them and some big content providers like Google, Reuters, Yahoo! and Excite are either forming alliance with mobile network operators or building their own mobile portals (Chang-tseh, Jones et al. 2008). Not to mention the mass adoption of the iPhone and its application store that offers a vast amount of applications; the same is happening now with the Android, Symbian and Windows mobile.

3.3.2.3.2 CONTENT AGGREGATORS.

A new kind of content aggregators starts to emerge, which repackages available data for distribution to wireless devices. Olympic Worldlink, for example, develops Mobile Futures that provides real-time information from the financial markets along with company, political and general interest news. It also links trade data from exchanges and clearing houses all over the world (Ling, Chou et al. 2005). To generalize, content aggregators are companies who repackage available data for distribution to wireless devices. The added value is in delivering content in the most appropriate package(Chang-tseh, Jones et al. 2008).

3.3.2.3.3 MOBILE PORTALS

Mobile portal providers play the role of a ‘‘gate’’ to mobile Internet; i.e. the first contact point of browsing mobile Internet (Müller-Veerse 2000; Kuo and Yu 2006). They are usually formed by aggregating applications (including e-mail, calendar and instant messaging) and content from various providers in order to become the user’s main supplier for web-based information that is delivered to the mobile terminal. Mobile portals are characterized by a greater degree of personalization and localization than regular web portals, since the success of M-Commerce applications is dependent on ease of use and on delivering the right information at the right moment (Chang-tseh, Jones et al. 2008).

3.3.2.3.4 MOBILE NETWORK OPERATORS (3G MOBILE OPERATOR)

Mobile network operators are those companies that are currently providing mobile telecommunications services, such as T-Mobile, Orange and Vodafone, and DoCoMo and Hutchison. These operators are trying to move up the value chain by providing more mobile services. Operators in this group play a key role in Mobile Commerce as a”gatekeeper” (Müller-Veerse 2000; Kuo and Yu 2006; Chang-tseh, Jones et al. 2008).

3.3.2.3.5 MOBILE SERVICE PROVIDER

Mobile service providers possess the contract and billing relationship with the customer, but they do not own any wireless technology infrastructure. These service providers can buy the

services at a discount rate (typically 20-25%) and then sell it under their brand name (Müller-Veerse 2000; Ling, Chou et al. 2005)

Mobile service providers serve their customers via the mobile network and they may not necessarily own any infrastructure. However, growing number of mobile services providers have been acquired by large network operators to strengthen their position in the M-Commerce market.

3.3.2.3.6 HANDSET VENDORS

Specifically responsible for selling all kinds of mobile equipments or retailing-related products to consumers, they play the role of a distributor for mobile equipment manufacturers and mobile network operators (Kuo and Yu 2006). In general, customers do not shop for a particular service provider or network operator, but rather for the handset brand. Hence, the handset vendors are critical in the M-Commerce value chain. The mobile phone has emerged into not only a consumer electronic device, but also something as personal as a pen or watch. Mobile handset manufacturers are coming closer to the traditional PDA manufacturers, as they are both offering smart phones and communicators with combined functionality (Ling, Chou et al. 2005; Chang-tseh, Jones et al. 2008).

3.3.2.4 CUSTOMERS

Customers are mainly divided into general consumers or enterprise users (Müller-Veerse 2000) Mobile Commerce consumers use their mobile phone primarily for voice, and more recently for SMS (Short Message Service) messages. A Nokia study on mobile VAS (Value Added Services) shows that the primary target markets for M-Commerce consumer are (Anonymous 2002):

- Teenagers (18 years and younger)
- Students (19-25 years)
- Young business people (25-36 years).

Business markets can be divided into three main categories of organizations that possess

Distinct M-Commerce needs:

- Sales driven organizations, such as manufacturing companies and banks
- Service-driven organizations, such as consultancies and system houses
- Logistics-driven organizations, such as taxi companies or courier services.

Depending on which segment it falls under, a company will become more likely to use a specific M-Commerce application, such as CRM (Customer Relationship Management), fleet management, or integration of mobile devices into corporate ERP (Enterprise Resource Planning) systems.

3.4 THE M-COMMERCE VS E-COMMERCE

At the time of writing this dissertation, the Mobile Commerce (M-Commerce) stands where the E-Commerce stood some 10 years ago (Kini 2009) similar concerns are being raised in terms of security, reliability, accessibility and confidentiality; but the lack of a standardized technology(that the E-Commerce had) drove the growth of M-Commerce into multiple directions in different parts of the world depending on the country, culture and the individual user(Kini 2009).

In order to engage in a commercial transaction using a mobile device (M-Commerce) or a Personal computer (E-Commerce) there are some critical basic factors on the infrastructure level that influence this engagement ; among these factors are four critical ones, namely the hardware and the software requirement, the connection or access and the content. Below Table 6 showing a comparison between the M-Commerce and the e-commerce across each factor:

Table 6 - Mobile Vs Electronic Commerce

Factor	E-Commerce	M-Commerce
Hardware Requirement	Low, similar systems around the world, the user(desktop) and the e-commerce server use similar technologies	Complicated, Complex technologies, different systems from one country to another, the user and the M-Commerce provider uses different technologies.
Software requirement	LOW, Almost every PC with internet connection has browsing capability benefiting from the open architecture of the PC	High, it is highly dependent on the technology standard used in the device and the service provider technology.
Connection or Access	Hard start - Modem Nowadays - Easy, Cheap, very high speeds with flat rates	Almost every mobile have access, the speed and the price depends on the provider's infrastructure and pricing schemes.
Content	Easily presented through the web browsers to virtually any PC	Complicated, content has to be delivered in a device-specific-configuration.

Source (Kini 2009)

It is clear that the introduction of the E-commerce has been much smoother than the introduction of the M-Commerce, but still the high penetration rates of mobile devices, and specially those capable of conducting M-Commerce transactions shows a promising future for the M-Commerce. It is seen that the M-Commerce is an extension and not a replacement for the E-commerce (Humphry Hung 2007).

3.5 THE MOBILE COMMERCE APPLICATIONS

Mobile applications have become especially valued in an age where time is precious and the weight attached to convenience is high. Mobile Commerce is expected to have a great impact on organizations, as wireless technologies and application begin to change the existing process, strategies, structures, roles of individuals, and even cultures of organizations(Hao Huang 2007).

With the large number of Mobile Commerce application available in the market, there is a need to analyze the nature of these services and try to classify them within schemes, on the next page is Table 7 showing the most popular mobile applications and examples.

In general, all of Mobile Commerce applications share two very important attributes the Mobility and reachability; within these two attributes the Mobile applications can be classified within six different categories:

- Time critical services (e.g. SMS-based notifications or alerts);
- Location-aware and location-sensitive service (e.g. mobile advertising, product location tracking); Identity-enacted service (e.g. mobile bank, mobile micropayments);
- Ubiquitous communications and content delivery services (e.g. video-on-demand, interactive game); Business process streamlining;

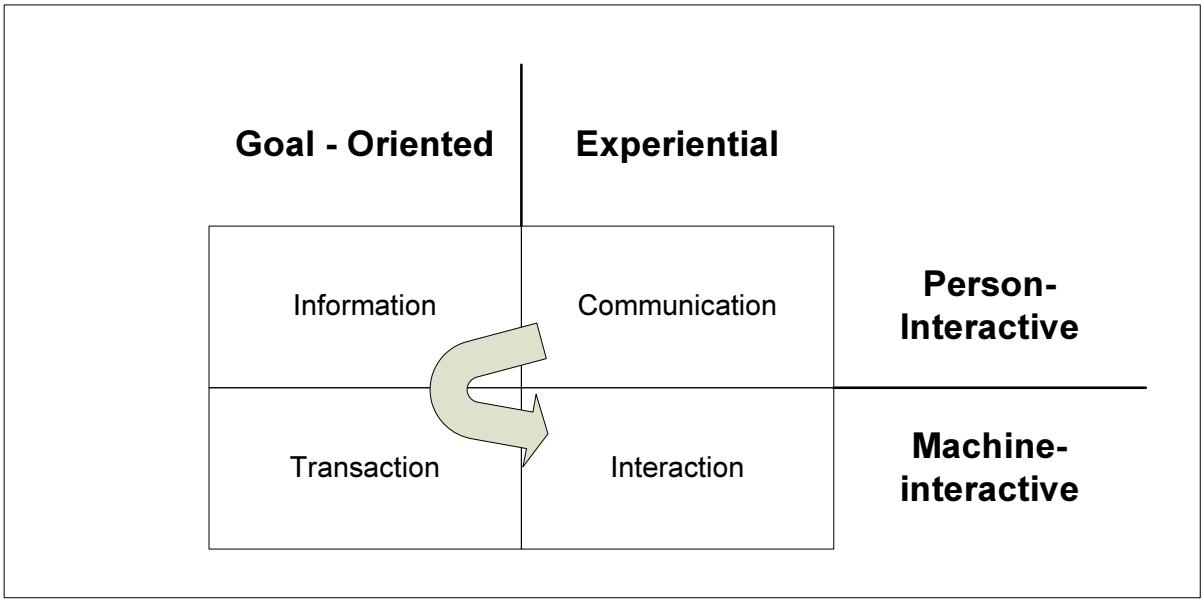
Table 7 - M-Commerce Applications

Application	Examples of services offered
Mobile banking	Mobile accounting Mobile brokerage Mobile financial information
Mobile entertainment	Mobile gaming Download of music and ring tones Download of videos and digital images Location-based entertainment services
Mobile information services	Current affairs (financial, sport and other news) Travel information Tracking services (persons and objects) Mobile search engines and directories Mobile office
Mobile marketing	Mobile couponing Direct (context-sensitive) marketing Organization of mobile events Mobile newsletters
Mobile shopping	Mobile purchasing of goods and services
Mobile ticketing	Public transport Sports and cultural events Air and rail traffic Mobile parking
Telematics services	Remote diagnosis and maintenance of vehicles Navigation services Vehicle tracking and theft protection Emergency services

Source: (Rajnish Tiwari 2006)

For the sake of this research, a marketing prospective developed by (Nysveen 2005) will be used; it suggest a classification that employs four primary axes: person-interactive versus machine interactive, and goal-oriented versus experiential service. “Person interactivity” occurs between people through a medium, while “machine interactivity” refers to the interaction between people and the medium; this can be seen in the Figure 11 below. In the “machine interactivity”, users can freely modify the content and form of a mediated environment (Nysveen 2005; Hao Huang 2007).

Figure 11 - Diffusion of M-Commerce Application In The Market



Source : (Hao Huang 2007)

This approach resulted in a four categories classification for the Mobile Commerce applications:

3.5.1 COMMUNICATION SERVICE

Mobile communications facilitate personal contact anytime, anywhere. While voice and short messages are currently the primary form of mobile communication, future mobile devices such as 3G and WiMAX phones are capable of handling much more information and providing broader bandwidth (Hao Huang 2007).

3.5.2 INFORMATION SERVICE

As people have different information needs and preferences, one of the challenges for mobile information systems is to take advantage of the convenience of handheld devices and provide personalized information to the right person in a preferred format (Hao Huang 2007).

The most popular Information services rely on the Location based services technology where it can relate the user and its location with the necessary information that may be interesting; the location based services include location-info service, mobile advertising, product location tracking service, locate a friend service, mobile inventory management, and patient monitoring service (Hao Huang 2007; Chang-tseh, Jones et al. 2008).

3.5.3 TRANSACTION SERVICE

Mobile services can also be used to enhance the efficiency of business processes and reduce transaction costs or improve service quality. Mobile financial applications are likely to be one of the most important components of Mobile Commerce (Hao Huang 2007).

Mobile banking services, which are an extension of internet banking, allow customers to use digital signatures and certificates:

- To manage personal account information (account history, transfers)
- To transfer funds in bank accounts or pre-paid accounts
- To receive alerts regarding bank information or payments due
- To handle electronic invoice payments.

Each of these services, secured end-to-end, can be performed from a handheld unit, which could be a smart phone, PDA or any mobile terminal. The consumer would no longer need to go to an automatic teller machine, to wait for a call centre operator or to log on to a computer. As for the banks, they can enhance their service level and reduce cost by minimizing calls at call centers(Chang-tseh, Jones et al. 2008).

3.5.4 INTERACTION SERVICES

Entertainment is an important interactive service that Mobile Commerce could provide. It includes mobile games, mobile music, video-on-demand and other services. The

convergence of entertainment, Internet and telecommunication industries has taken steps towards creating completely new ways to spend time (Hao Huang 2007; Chang-tseh, Jones et al. 2008)

PART THREE:

THEORY PRESENTATION

THIS PART CONSISTS OF TWO MAIN CHAPTERS:

- THE FIRST CHAPTER IS A GENERAL TECHNOLOGY ACCEPTANCE LITERATURE REVIEW WITH EMPHASIS ON MOBILE COMMERCE.
- THE SECOND CHAPTER PRESENTS THE RESEARCH MODEL AND THE HYPOTHESIS DEVELOPMENT ALONG WITH MODERATOR'S EFFECTS.

4 LITERATURE REVIEW

In this chapter, the literature related to the Information systems adoption theories will be reviewed in general along with the theories and literature related to the Mobile Commerce in specific.

4.1 INTRODUCTION

Most of the research on the Mobile Commerce adoption has been conducted using traditional adoption models and theories (AlHinai 2007); these traditional adoption models mostly revolves around the technology acceptance theories. The fact that the Research theme is quite modern, most of the relevant references are no more than 8 years old, except for the literature on the Technology Acceptance Model (TAM), the theory of planned behavior (TPB) and the theory of reasoned action (TRA) those three date back to the 70s and the 80s.

Another interesting aspect of the Mobile Commerce adoption literature is the approaches used to understand the adoption process by the Mobile Commerce user; besides being a Technology user, Mobile Commerce users are also a network member and a consumer as well. Most of the research done on the adoption of Mobile Commerce implemented traditional theories like TAM tackling the technology usage and adoption aspects and forgot about being a consumer or a network member. We cannot ignore that these users are usually part of a social network of people such as friends and family. This network would usually influence an individual's perceptions, opinions and actions in regard to different objects including service offers. People usually recommend good services to each other and equally they oppose and discourage unfavorable services to each other. Therefore, depending on the level of interaction with others, the decision to adopt or reject a certain service in not only a result of a mere personal evaluation, but is usually affected by others (AlHinai 2007). Another requirement to use Mobile Commerce service is the user need to be subscribe to a mobile network that provides the services which results in becoming a mobile

user; only after that, s/he can make a decision about becoming or not becoming an M-Commerce adopter. Consequently, being a customer of a business in the first place raises the importance of many factors that can affect subsequent intentions and decisions to accept new service offers. A customer's evaluation of such factors can result in either positive or negative outcomes. In either case, this evaluation would have an impact on his/her future service adoption decisions (AlHinai 2007). Below is a short overview of the roles of the Mobile Commerce users:

4.1.1 M-COMMERCE ADOPTERS AS TECHNOLOGY USERS

Here, all adoption factors studied relate one way or the other to the technology or service characteristics and its use. Studies investigating this role mainly use traditional theories such as the Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB) and the Diffusion of Innovation (DOI) theory. Based on these theories researchers of Mobile Commerce adoption studied the effects of factors such as usefulness, ease of use, enjoyment of using a service, content and system quality, impact of technical issues such as bandwidth and line capacity and so on (Davis 1989; Wu and Wang 2005; AlHinai 2007; Venkatesh and Bala 2008).

4.1.2 M-COMMERCE ADOPTERS AS NETWORK MEMBERS

This perspective is based on the fact that an individual's decisions and behaviors are not made solely by the user, but rather are influenced by the opinions and recommendations of other important people (i.e. family, friends, colleagues and other important people).

The Act of being a member of a social network, the daily interaction, sharing and exchanging of thoughts and ideas makes the word of mouth the most effective channels through which positive and negative ideas and perceptions spread in a social setting.

Ignoring such effects in M-Commerce adoption research would result in an incomplete understanding of the power of social networks in influencing one's beliefs, attitudes and perceptions. These effects has been considered by some of the Mobile Commerce adoption

researchers in order to get a more comprehensive understanding of the Adoption process reflecting the Network element side by side to the Technology element (Arvind and Albert 2005; Pedersen 2005; AlHinai 2007).

4.1.3 M-COMMERCE ADOPTERS AS CONSUMERS

This role or perspective makes a key difference between M-Commerce adoption research and adoption research for most traditional technologies. The majority of adoption determinants that influence individual acceptance of traditional technologies (such as PCs) mostly lie in the interaction of the user with the technology and/or with people around(AlHinai 2007). However, the case with mobile services is different. Mobile service users are normally customers of a business and pay fees in order to receive services for as long as they remain customers of the business (i.e. subscribers to the mobile network). Therefore, there is a continuous interaction between the mobile customer and his/her service provider(s). The Relation between the User and the Mobile network operator gives importance to the impact of marketing and business related factors such as cost/price, value perceptions, promotions, offers and people exposure to the services through different marketing efforts. As a result focusing on M-Commerce adopters as technology users only would mean omitting a great deal of factors related to the other two roles(AlHinai 2007).

4.2 THE THEORETICAL BACKGROUND "GENERAL ADOPTION INFORMATION SYSTEMS THEORIES"

The collection and Review process depend mainly on online searches in scientific databases through the electronic library besides the Internet search engines; searching for Key words like "M-Commerce ", "Mobile Commerce" and "Mobile transactions" then collecting and reviewing relevant research. This research review revealed that most of the mobile application literature revolves around the traditional adoption theories; which in turn are either based or extracted from other theories as mentioned in the above introduction. Most of the research done in this field revolved around the traditional technology adoption models, in this section, the adoption theories will be shortly presented within the context of the IS adoption research. These will be illustrated briefly in the following theoretical background section.

4.2.1 TECHNOLOGY ACCEPTANCE MODEL

This is the most heavily used theory in the realm of Mobile Commerce adoption research. A simple search using Google scholar in February 2010 revealed that the article published in 1989 by Davis in the MIS quarterly under the name of "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology" was cited 6936 times where the Social science citation index returns, for the same date and the same article, 1998 citations.

Many Studies in the Mobile Commerce / Applications sector have used it and it is proven to be the most robust and parsimonious. The History of TAM goes back to 1989 when Davis adapted Ajzen and Fishbein's (1980) theory of reasoned action (TRA) to specifically predict and explain the acceptance of new technologies. The result was the technology acceptance model (TAM). In the technology acceptance model, perceived usefulness (PU) and perceived ease of use (PEU) are two core beliefs determining an individual's behavioral intention towards new technology usage. The former is defined as "the extent to which a person believes that using the system will enhance his or her job performance", while the latter

refers to "the extent to which a person believes that using the system will be free of effort" (Davis 1989; Guo 2007).

One of the key constructs in the TRA “attitude toward the behavior" was eliminated from the TAM; because an individual's attitude cannot always completely determine his or her behavioral intention, especially in task-oriented behavior. Furthermore, TAM suggests that external factors (e.g., system quality) only have indirect influence on behavioral intention through beliefs (i.e., perceived usefulness and perceived ease of use). (Guo 2007)

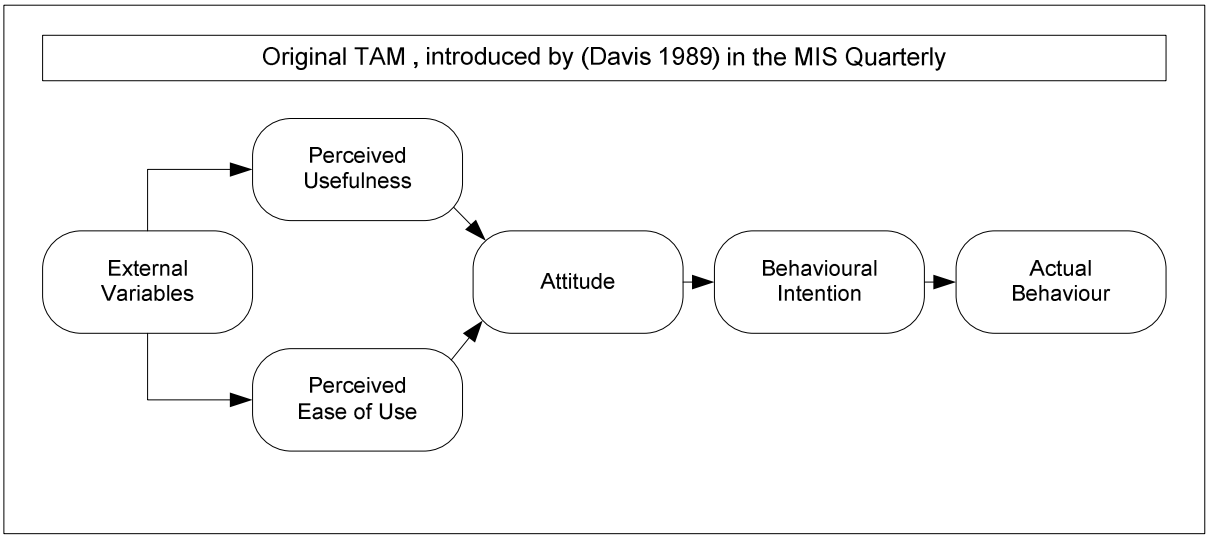
TAM theorises that an Individual’s behavioral intention to use a system is determined by two beliefs: perceived usefulness; defined as the extent to which a person believes that using the system will enhance his or her job performance, and perceived ease of use; which is defined as the extent to which a person believes that using the system will be free of effort. It also theorises that the effects of external variables (e.g., system characteristics, development process , training) on intention to use are mediated by perceived usefulness and perceived ease of use (Venkatesh and Davis 2000).

Many constructs were added to the main model to serve the nature of the research conducted. Since the initial Model of the TAM introduced by (Davis 1989) until today some changes has been introduced to the Model, these changes introduced some new Constructs and removed some others in order to accommodate the nature of the research being conducted; the most famous versions of this model are given below on a chronological order:

4.2.1.1 ORIGINAL TAM

Introduced by (Davis 1989) in the MIS Quarterly, this Model came to be known as the Original Technology acceptance model, as mentioned above it was based on Ajzen and Fishbein’s (1980) theory of reasoned action .

Figure 12 - Original TAM

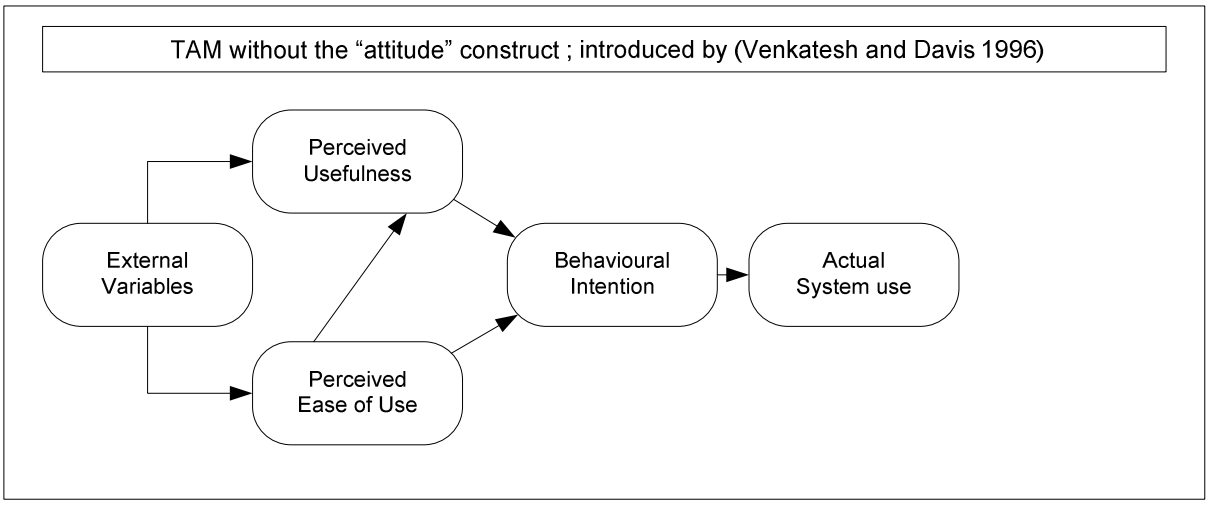


source : (Davis 1989)

4.2.1.2 TAM WITHOUT THE ATTITUDE

This has been introduced by (Venkatesh and Davis 1996), eliminating the Attitude Constructs as a mediator between the "Perceived Ease of Use", the "Perceived Usefulness" and the "Behavioral Intention". From that time on, all the TAM models were introduced without the "Attitude".

Figure 13 - TAM Without The "Attitude" Construct



Source : (Venkatesh and Davis 1996)

4.2.1.3 EXTENDED VERSION: TAM2

This Extension came almost 11 years after the introduction of the first Model in 1989; the extension came from the same researchers who introduced the earlier versions of TAM. In this case, TAM was used as a starting point, and TAM2 incorporated additional theoretical constructs spanning social influence process (subjective norm, voluntariness and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability and perceived ease of use (Venkatesh and Davis 2000).

The roots of the "Theory of reasoned action" and the "Theory of planned behavior "can be seen clearly in this extended version. A later modified version of the TAM2 came out on the same year where (Venkatesh and Morris 2000) introduced the gender as a main element.

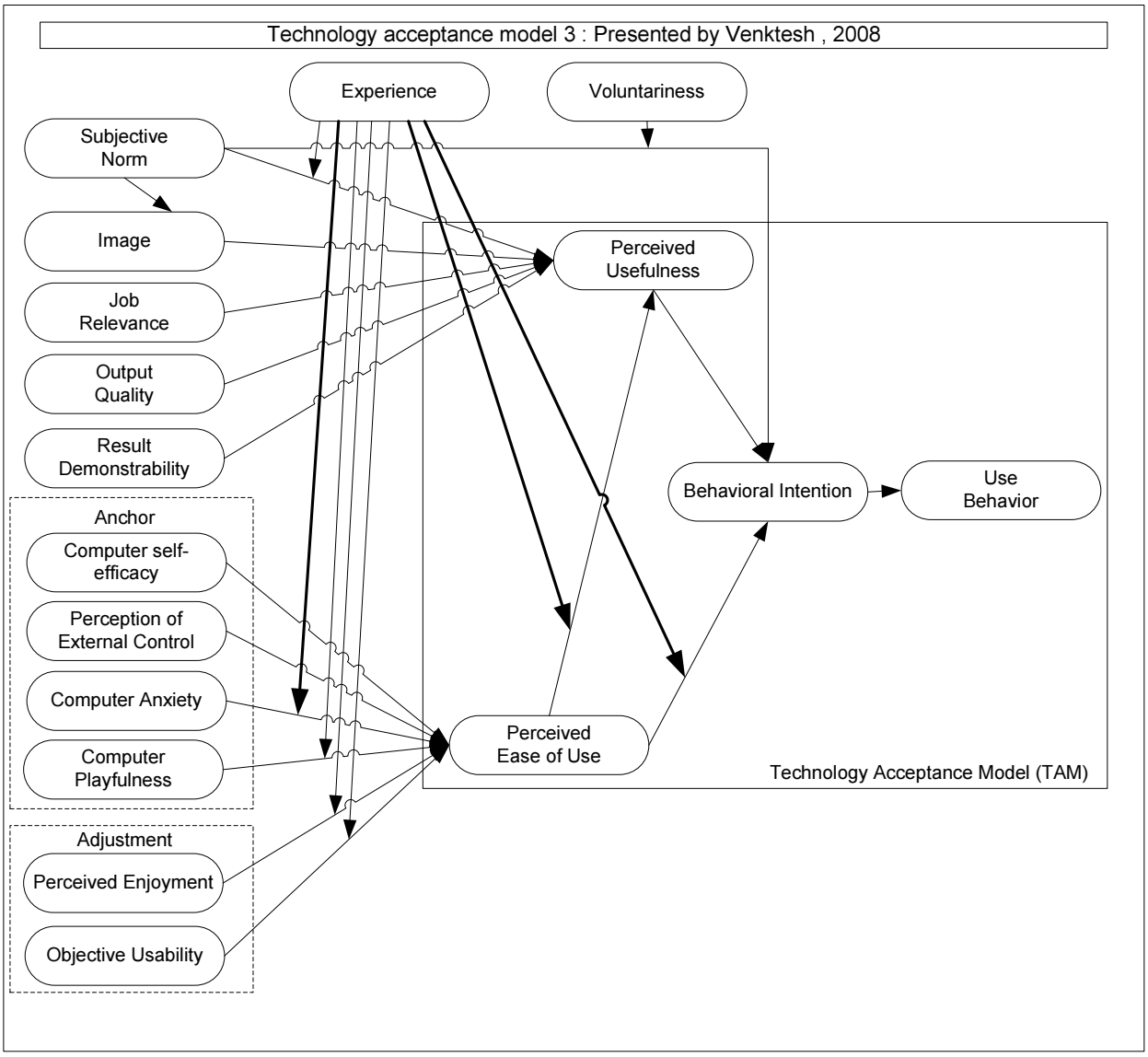
4.2.1.4 TAM 3

TAM3 presents a comprehensive Nomological network of the determinants of individuals IT adoption and use. This model developed on the bases of TAM2. Basically, TAM3 is a combination of TAM2 and the model of perceived ease of use presented by Venkatesh (2000); the combination resulted in an integrated model of technology acceptance three.

TAM3 presented three new relationships:

- Perceived ease of use to perceived usefulness, moderated by experience
- Computer anxiety to perceived ease of use, moderated by experience
- Perceived ease of use to behavioral intention, moderated by experience
- These new relations are shown in thicker arrows in the Figure 14 below:

Figure 14 - TAM 3



Source : (Venkatesh and Bala 2008)

TAM 3 represents a complete nomological network determinants of IT adoption and use, the key strength of TAM3 is its comprehensiveness and potential for actionable guidance, while TAM presented a parsimonious model (Venkatesh and Bala 2008) .

Since TAM3 includes within it the TAM1 and TAM2 components, the researcher decided not to define the constructs in each presented model above, but to represent them within the more comprehensive TAM3; the total number of the constructs are 20 and they are defined in (Venkatesh and Bala 2008) as:

Attitude: Individual's positive or negative feeling about performing the target behavior (e.g., using a system).

Behavioral intention: The degree to which a person has formulated conscious plans to perform or not perform some specified future behavior.

Computer anxiety: The degree of an individual's apprehension, or even fear, when she/he is faced with the possibility of using computers.

Computer playfulness: The degree of cognitive spontaneity in microcomputer interactions.

Computer self-efficacy: The degree to which an individual beliefs that he or she has the ability to perform specific task/job using computer.

Effort expectancy: The degree of ease associated with the use of the system.

Facilitating conditions: The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.

Image: The degree to which use of an innovation is perceived to enhance one's status in one's social system.

Job relevance: Individual's perception regarding the degree to which the target system is relevant to his or her job.

Objective usability: A comparison of systems based on the actual level (rather than perceptions) of effort required to complete specific tasks.

Output quality: The degree to which an individual believes that the system performs his or her job tasks well.

Performance expectancy: The degree to which an individual believes that using the system will help him or her to attain gains in job performance.

Perceived ease of use: See the definition of effort expectancy.

Perceived enjoyment: The extent to which the activity of using a specific system is perceived to be enjoyable in its own right, aside from any performance consequences resulting from system use.

Perceived usefulness: See the definition of performance expectancy.

Perception of external control: See the definition of facilitating conditions.

Result demonstrability: Tangibility of the results of using the innovation.

Social influence: The degree to which an individual perceives that important others believe he or she should use the new system.

Subjective norm: Person's perception that most people who are important to him think he should or should not perform the behavior in question.

Voluntariness: The extent to which potential adopters perceive the adoption decision to be non-mandatory.

4.2.2 The Unified Theory Of Acceptance And Use Of Technology (UTAUT)

Venkatesh et al. (2003) proposed the unified theory of acceptance and use of technology (UTAUT) model by reviewing and consolidating eight representative user acceptance models. The eight prominent models are the TRA, TAM, TPB, Decomposed TPB (DTPB) motivational model (MM) ,model of PC utilization (MPCU), innovation diffusion theory (IDT), and social cognitive theory (SCT) (Venkatesh, Morris et al. 2003).

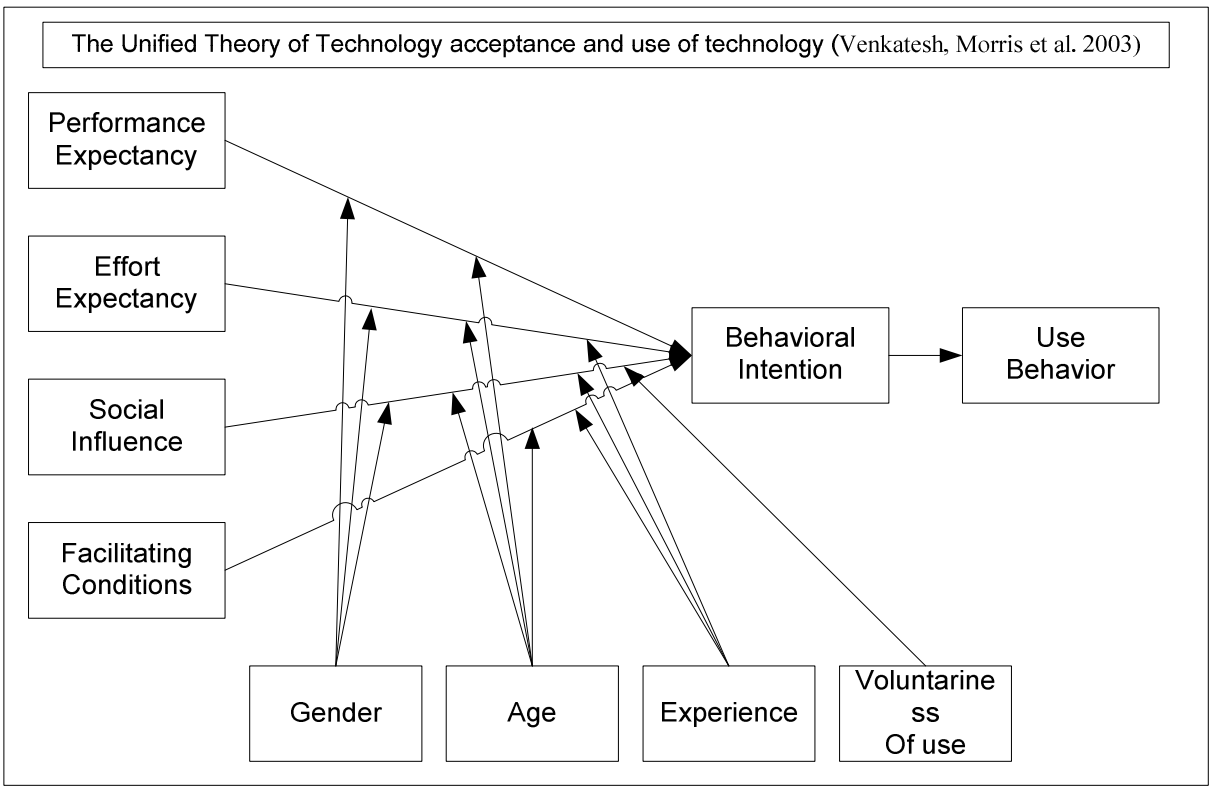
Venkatesh et al. (2003) aimed at integrating critical constructs across the eight models into a structural model thereby providing a more powerful explanation of the user acceptance of information technology in various situations than any individual model. Venkatesh et al. (2003) identified performance expectancy, effort expectancy, and social influence as three significant direct determinants of behavioral intention.

Specifically, Performance Expectancy is defined as "the degree to which an individual believes that using the system will help him or her to attain gains in [job] performance". Effort expectancy is defined as "the degree of ease associated with the use of the system". Social influence, as defined by UTAUT, is "the degree to which an individual perceives that important others believe he or she should use the new system". Three existing constructs

capture the concept of social influence: subjective norms in TRA, TPB and DTPB, social factors in MPCU and image in IDT (Venkatesh, Morris et al. 2003; Guo 2007)

This Model developed by (Venkatesh, Morris et al. 2003) has given more comprehensive understanding of the technology adoption as they concluded that the UTAUT model could explain up to 70% of the Variance in the intention ((Venkatesh, Morris et al. 2003).

Figure 15 - UTAUT



Source : (Venkatesh, Morris et al. 2003)

Below are the constructs definitions from the UTAUT as introduced in (Venkatesh, Morris et al. 2003)

Effort expectancy: The degree of ease associated with the use of the system.

Facilitating conditions: The degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system.

Performance expectancy: The degree to which an individual believes that using the system will help him or her to attain gains in job performance.

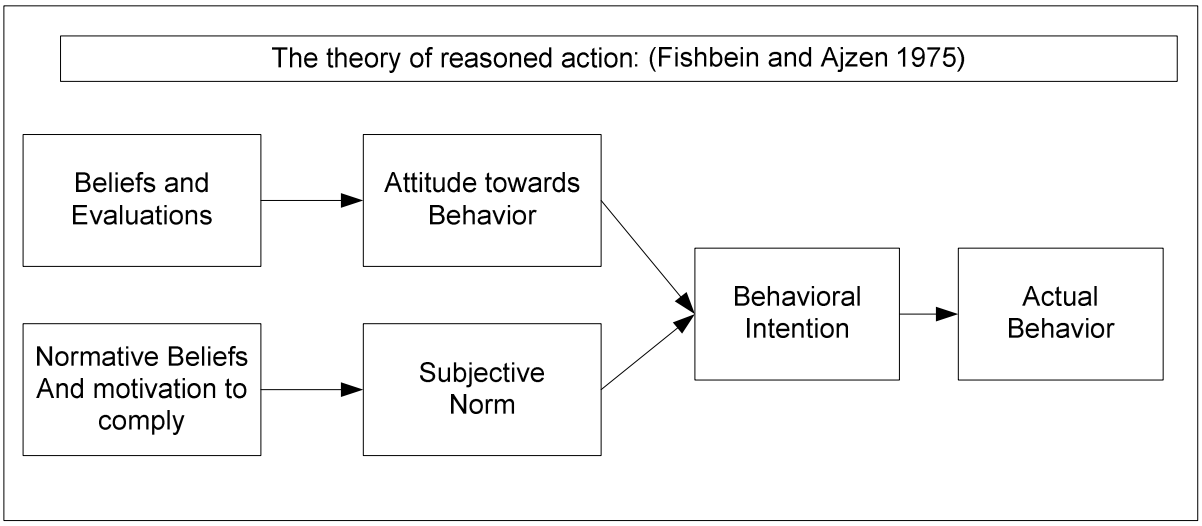
Social influence: The degree to which an individual perceives that important others believe he or she should use the new system.

As mentioned above this Unified View has been developed on the biases of eight theories; as to avoid any repetition, TAM and the "COMBINED TAM AND TPB" will not be discussed where the remaining six theories are to be discussed briefly below:

4.2.3 THEORY OF REASONED ACTION (TRA)

The Theory of Reasoned Action is considered to be a general theory and has been applied to explain behavior beyond adoption of technology. It is the most systematic and extensively applied approach to attitude and behavior research (Sally Rao 2007).

Figure 16 - TRA



Source : (Legris, Ingham et al. 2003)

Fishbein and Ajzen (1975) suggested that an individual's behavioral intention is jointly determined by two independent constructs, attitude towards the behavior and subjective norms. The former refers to the individual's positive or negative feelings about performing a specific behavior (e.g. using a new technology), while the latter is defined as the degree to which an individual perceives that important others believe he or she should perform a given behavior. Numerous empirical tests have shown that the theory of reasoned action is a remarkably robust model for explaining human behavior in a wide variety of settings. As the

first influential theoretical model of human behavior, TRA has been frequently used as a theoretical foundation of subsequent prominent models, such as TPB and TAM (Fishbein 1975; Guo 2007; Sally Rao 2007)

4.2.4 MOTIVATIONAL MODEL (MM)

The motivational model (MM) was adapted to user acceptance by Davis, Bagozzi, and Warshaw (1992). The model employs two key constructs: extrinsic motivation and intrinsic motivation (Venkatesh, Speier et al. 2002).

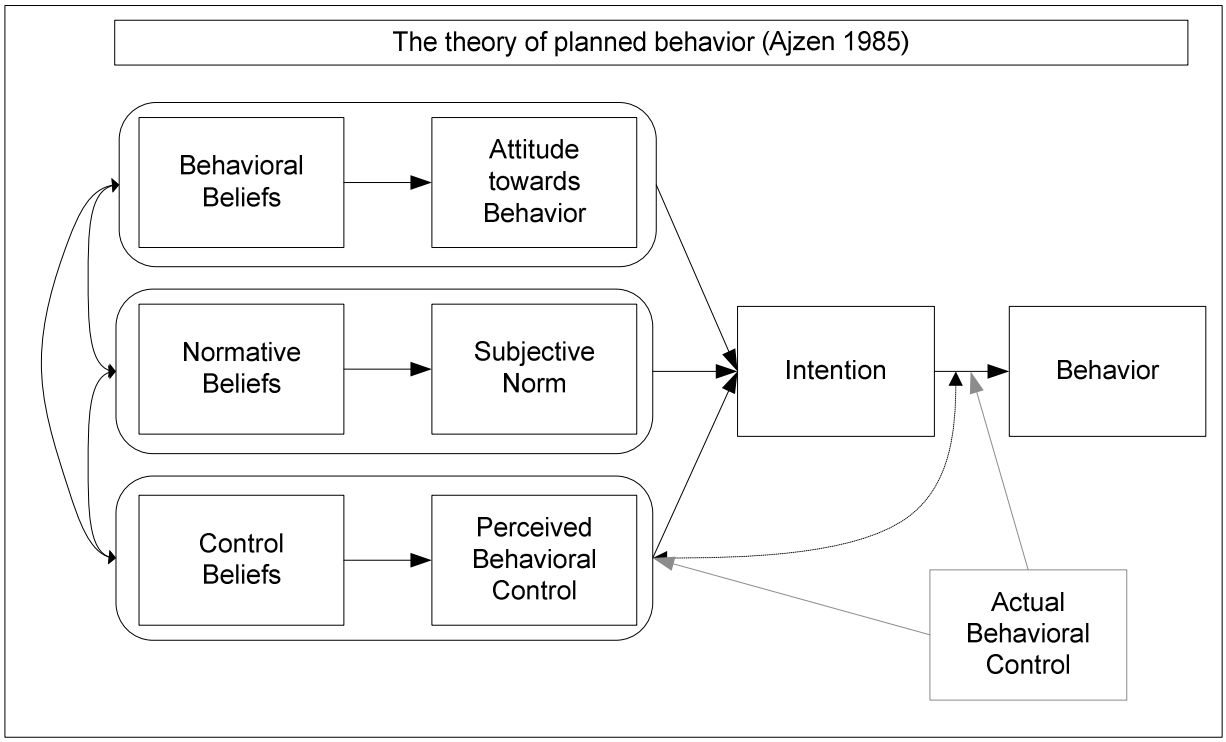
(Fred, Richard et al. 1992) proposed that people expend effort due to both extrinsic and intrinsic motivation. Extrinsic motivation is defined as the performance of an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself. Intrinsic motivation refers to the performance of an activity for no apparent reinforcement other than the process of performing the activity per se (Fred, Richard et al. 1992; Teo, Lim et al. 1999).

4.2.5 THEORY OF PLANNED BEHAVIOR (TPB)

Stemming from social psychology, the TPB is a general model that has been applied in many diverse domains. The model has been developed by Ajzen who introduced the TRA in 1975 as to overcome the major application limitation of TRA that ignores an individual's volitional control on his or her behavior- Ajzen (1991) extended the TRA model by introducing a new construct, perceived behavioral control, which led to the theory of planned behavior TPB(Guo 2007; Sally Rao 2007).

TPB asserts that the actual behavior is determined directly both by behavioral intention and perceived behavioral control. Perceived behavioral control was included to account for the availability of both cognitive and situational resources required to carry out behavior. Behavioral intention is, therefore, formed by one's attitude, subjective norm and perceived behavioral control (Ajzen 1985; Guo 2007; Sally Rao 2007).

Figure 17 - TPB



Source: http://www.people.umass.edu/aizen/tpb.diag.html

4.2.6 COMBINED TAM AND TPB (C-TAM-TPB)

This Model Developed by (Taylor and Todd 1995) is as it sounds, it is a combination of both the predictors of the TPB with the perceived usefulness from the TAM to provide a hybrid model. The resulting model core constructs include Attitude toward Behavior, Subjective Norm, Perceived Behavioral Control and the Perceived Usefulness (Taylor and Todd 1995; Venkatesh, Morris et al. 2003)

4.2.7 MODEL OF PC UTILIZATION (MPCU)

Derived largely from Triandis' (1977) theory of human behavior, this model presents a competing perspective to that proposed by TRA and TPB. Thompson et al. (1991) adapted and refined Triandis' model for IS contexts and used the model to predict PC utilization. However, the nature of the model makes it particularly suited to predict individual

acceptance and use of a range of information technologies. Thompson et al. (1991) sought to predict usage behavior rather than intention (Venkatesh, Morris et al. 2003).

4.2.8 INNOVATION DIFFUSION THEORY (IDT)

Originating from sociology and developed by (Moore and Benbasat 1991) IDT views innovation diffusion as a particular type of communication process in which the messages about a new idea are passed from one member to another in a social system(Yi, Jackson et al. 2006).

The diffusion is a macro process concerned with the spread of an innovation from its source to the public whereas the adoption process is a micro process that is focused on the stages individuals go through when deciding to accept or reject an innovation(Sally Rao 2007). Within information systems, Moore and Benbasat (1991) adapted the characteristics of innovations presented in Rogers and refined a set of constructs that could be used to study individual technology acceptance (Venkatesh, Morris et al. 2003) these core constructs are listed in Table 8 along with their definitions:

Table 8 - IDT Constructs

Core Constructs	Definitions
Relative Advantage	The degree to which an innovation is perceived as being better than its precursor
Ease of Use	The degree to which an innovation is perceived as being difficult to use
Image	The degree to which use of an innovation is perceived to enhance one's image or status in one's social system.
Visibility	The degree to which one can see others using the system in the organization.
Compatibility	The degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters.
Results Demonstrability	The tangibility of the results of using the innovation, including their observability and communicability.
Voluntariness of Use	The degree to which use of the innovation is perceived as being voluntary, or of free will.

Source : (Moore and Benbasat 1991)

4.2.9 SOCIAL COGNITIVE THEORY (SCT)

Stemming from the sociology, the SCT was revisited by Compeau and Higgins (1995) where they applied and extend the SCT to the context of computer utilization. The core constructs in the SCT are: "Outcome Expectations Performance", "Outcome Expectations Personal", "Self Efficacy", "Affect" and Anxiety (Venkatesh, Morris et al. 2003).

Self-efficacy and outcome expectations are positively influenced by encouragement of others and others' use of computers. Self-efficacy is important in an organizational setting when it comes to successful IS implementation. This provides implications for organizational support, training, and implementation(Dickinger 2007).

4.3 THE "INFORMATION SYSTEM" RESEARCH IN THE MOBILE COMMERCE ADOPTION REALM

Since most of the information system adoption theories have been developed to accommodate computer adoption and internet adoption, many researchers in the Mobile Commerce adoption field introduced new constructs to these theories as to better suite the nature of Mobile Commerce adoption that is very different from the internet or computers adoption as illustrated in Table 9 below:

Table 9 - M-Commerce Vs E-Commerce Adoption

	Internet-based E-Commerce	**M-Commerce**
End user devices	PC or Laptop computers; Little differences in functionalities; Large screen; rich audio and video; Standard keyboard; easy input ;Sufficient power supply	Mobile phones or PDAs; Big differences in functionalities; Limited processing capacity and memory; Small screen; limited audio and video; Limited power supply.
Communication network	Internet or LAN Broadband; high transmission speed Low cost	Various types of wireless network; lack of uniform standards; Limited bandwidth, low transmission speed High cost
Task, application, and environment	Mainly used in work ;Mainly used indoor	Blurred boundary between work and leisure; usage Used in many environments
Value proposition	Complex calculations; massive storage; high transmission speed; Low cost; High intelligence application	Ubiquitous communication; Time and location critical; Location based application; Personalized applications and services

Source : (Zhang J J 2002; Gang 2008)

Many of the researchers tried to study the mobile services adoption based on Intention-Based models rooted in the cognitive psychology like the TRA and the TPB and later the TAM and TAM2 (López-Nicolás, Molina-Castillo et al. 2008). Others used Diffusion of innovation theory, UTAUT and others; all these theories were tuned to meet the requirements of the research on Mobile services adoption; for example Bruner and Kumar (2005) and Wu and Wang (2005) introduced the "perceived risk and cost" in the revised TAM. Furthermore, Teo and Pok (2003) used DTPB to study the "adoption of WAP-enabled mobile phones among

Internet users." These studies have either modified or extended traditional IT adoption theories to apply the theories in M-Commerce user acceptance. All these publications showed that such researches are looking for a way to better fit the IS research within the M-Commerce either by adding constructs or by integrating more than one theory in one model (Gang 2008). Below is a Review of IS model comparison done in the dissertation work of (Dickinger 2007):

Table 10 - Review Of IS Models Comparison

Model Comparisons	Models	Findings
Mathieson (1991)	TAM, TPB	The variance in intention explained by TAM 70%, TPB 62%.
Davis et al. (1989)	TRA, TAM	The variance in intention and use explained by TRA was 32% and 26%, and TAM was 47% and 51% respectively.
Taylor and Todd (1995)	TAM, TPB, Decomposed TPB	The variance in intention explained by TAM was 52%, TPB was 57% and DTPB was 60%.
Venkatesh et al. (2003)	TRA, SCT, TAM/TAM2 TPB/DTPB, MM, UTAUT, C-TAM/TPB, MPCU, IDT	UTAUT outperformed the other eight models which explained between 17% and 53% of variance in user intentions to use information technology while UTAUT was confirmed with 70% of explained variance in user intentions.
Plouffe et al. (2001)	TAM, IDT	The variance in intention explained by TAM was 33% and IDT was 45%.

Source : (Dickinger 2007)

For the purpose of this research, the UTAUT will be used to study and analyze the adoption of mobile services. As mentioned earlier, the UTAUT is a mixture of 8 theories introduced by (Venkatesh, Morris et al. 2003) where they concluded that the UTAUT model could explain up to 70% of the Variances in Intention and found to outperform the eight individual models including the TAM (Venkatesh, Morris et al. 2003). Also (Gang 2008) and (Carlsson, Carlsson et al. 2006) recommended future research on Mobile services adoption using the UTAUT .

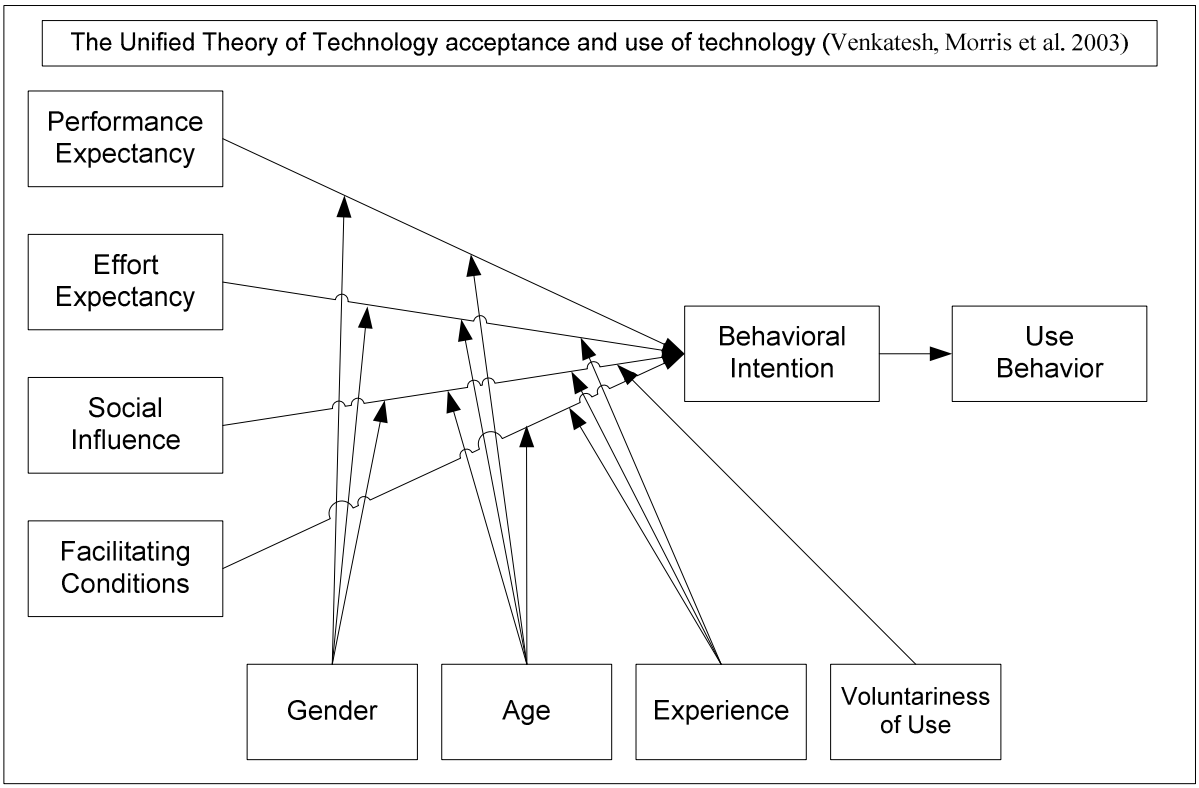
5 THE RESEARCH MODEL AND HYPOTHESES DEVELOPMENT

Having in mind the theme of this research, The researcher decided to approach the adoption of mobile services from the IS perspective, this approach has been often used in many studies tackling the adoption of mobile services like (Amberg, Hirschmeier et al. 2004; Yang 2005; Carlsson, Walden et al. 2006; Koivumaki, Ristola et al. 2006; Yi-Shun, Hsin-Hui et al. 2006; June, Lu-Zhuang et al. 2007; Lei-da 2008). Amongst IS adoption models, the UTAUT will be taken as the base for model development as it blends eight theories as illustrated earlier.

5.1 THE RESEARCH MODEL

The relation between the “mobile and the user” will be reevaluated and extended; trying to find out how it influences the attitude towards adopting Mobile Commerce applications, during which an investigation of the current Mobile Commerce adoption drivers and the intention to use them will be done.

Figure 18 - Unified Theory of Acceptance And Use of Technology



Source: (Venkatesh, Morris et al. 2003)

Using the original model of UTAUT (Venkatesh, Morris et al. 2003),the following constructs will be excluded from the research Model:

Facilitating Conditions: as per the construct description by (Venkatesh, Morris et al. 2003), it relates mostly to assistance given to use the system in a work environment where the use of the system is mandatory, which is not the case usually in M-Commerce , as users are independently and freely choosing whether to use or not to use the system.

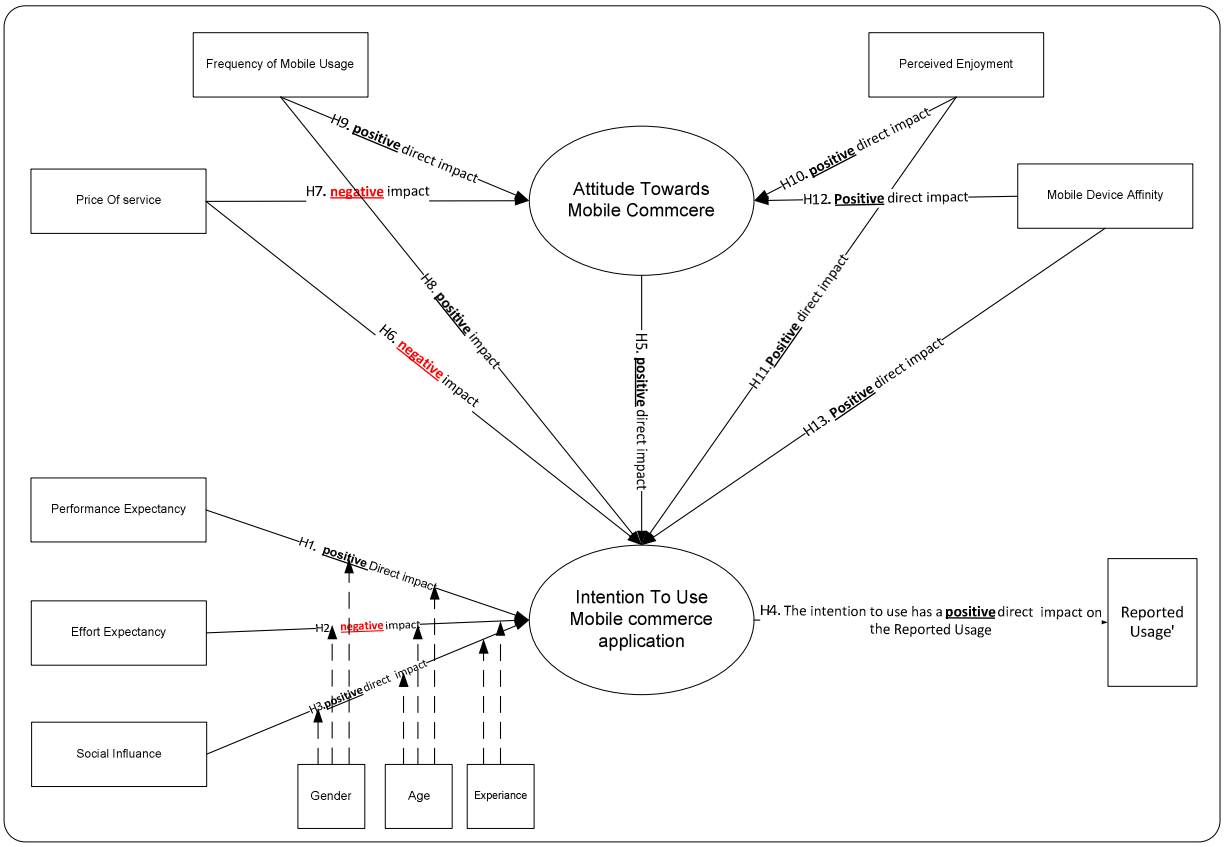
Voluntary Settings: its initial function as a mediator is unnecessary here; as the study will be conducted on individuals who are already free to make their own decision towards adoption of the technology / system.

5.2 HYPOTHESES DEVELOPMENT

Besides having the remaining original constructs from the UTAUT, another five constructs will be added to the model. Below is a description of each of the latent constructs along with the developed related hypotheses that will be tested in this research:

The New modified model is illustrated in Figure 19 :

Figure 19 - Hypothesized Relations



Source: Own Presentation

5.2.1 PERFORMANCE EXPECTANCY

The Performance Expectancy is defined by (Venkatesh, Morris et al. 2003) as "The degree to which an individual believes that using the system will help him or her to attain gains in job performance". Out from the eight models blended together to form the UTAUT constructs

from five models pertain to Performance Expectancy ; among these is the construct Perceived Usefulness from (Davis 1989; Davis, Bagozzi et al. 1989) and the Relative Advantage from (Moore and Benbasat 1991). For more Comprehensive View, on the next page is Table 11 displaying the Performance Expectancy, Effort Expectancy and Social Influence latent constructs as presented in the UTAUT and their roots along with original definitions:

One of the key reasons why people indented to use Mobile technologies is the expected performance (usefulness) obtained from using this Service; this leads to the First Hypotheses:

> **H1: Performance Expectancy has a positive direct impact on the Intention to Use Mobile Commerce Applications.**

Gender and Age are considered to be influential moderators acting on this relationship.

5.2.2 Effort Expectancy

It is defined by (Venkatesh, Morris et al. 2003) as "the degree of ease associated with the use of the system". This is a classical construct that can be found in most of the IS theories i.e. Technology Acceptance Model under the name of " perceived ease of use" (Davis 1989). Three constructs from the existing eight models capture the concept of Effort Expectancy since there is substantial similarity among the construct definitions and measurement scales (Venkatesh, Morris et al. 2003) .

One of the key hurdles against adopting mobile services is the effort that has to be invested by the user to successfully use a specific mobile application and to get the desired benefit from it. The relationship binding the intention to use a mobile service and the effort to use it is a negatively correlated relationship, this leads to the second Hypotheses:

> **H2: Effort Expectancy has a negative direct impact on the Intention to Use Mobile Commerce Applications.**

Gender, Age and experience are considered to be influential moderator on this Construct

Table 11 - UTAUT- SI, EE And PE Origins

Construct (UTAUT)	Construct origin	Definition
Performance Expectancy	Perceived Usefulness (Davis 1989; Davis et al. 1989)	The degree to which a person believes that using a particular system would enhance his or her job performance.
	Extrinsic Motivation (Davis et al. 1992)	The perception that users will want to perform an activity because it is perceived to be instrumental in achieving valued out-comes that are distinct from the activity itself, such as improved job performance, pay, or promotions
	Job-fit (Thompson et al. 1991)	How the capabilities of a system enhance an individual's job performance.
	Relative Advantage (Moore and Benbasat 1991)	The degree to which using an innovation is perceived as being better than using its precursor.
	Outcome Expectations (Compeau and Higgins 1995b; Compeau et al. 1999)	Outcome expectations relate to the consequences of the behavior. Based on empirical evidence, they were separated into performance expectations (job-related) and personal expectations (individual goals). For pragmatic reasons, four of the highest loading items from the performance expectations and three of the highest loading items from the personal expectations were chosen from Compeau and Higgins (1995b) and Compeau et al. (1999) for inclusion in the current research. However, our factor analysis showed the two dimensions to load on a single factor.
Effort Expectancy	Perceived Ease of Use (Davis 1989; Davis et al. 1989)	The degree to which a person believes that using a system would be free of effort.
	Complexity (Thompson et al. 1991)	The degree to which a system is perceived as relatively difficult to understand and use.
	Ease of Use (Moore and Benbasat 1991)	The degree to which using an innovation is perceived as being difficult to use.
Social Influence	Subjective Norm (Ajzen 1991; Davis et al. 1989; Fishbein and Azjen 1975; Mathieson 1991; Taylor and Todd 1995a, 1995b)	The person's perception that most people who are important to him think he should or should not perform the behavior in question.
	Social Factors (Thompson et al. 1991)	The individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual has made with others, in specific social situations.
	Image (Moore and Benbasat 1991)	The degree to which use of an innovation is perceived to enhance one's image or status in one's social system.

Source: (Venkatesh, Morris et al. 2003)

5.2.3 SOCIAL INFLUENCE

Social Influence is defined as “the degree to which an individual perceives that important others believe he or she should use the new system. “(Venkatesh, Morris et al. 2003) this is also a classical construct that has been represented in traditional adoption theories under different names and definitions yet very similar in meaning; one of its most popular names is the “subjective norm“ which has been used by the TRA, TAM2, TPB/DTPB and the combined TAM/TPB.

This construct captures the explicit or implicit belief that the users behavior is influenced by the way in which they believe others will view them as a result of having used the technology and in this case the Mobile Services.

As presented by (Venkatesh, Morris et al. 2003) Theory suggests that women tend to be more sensitive to others’ opinions and therefore find Social Influence to be more salient. From the consumer research point of view, the potential users seek to differentiate their social status through using new and innovative products (Maria, Dimitrios et al. 2007) and in this specific case “the new Mobile Service”, this leads to the third hypotheses:

> **H3: Social Influence has a positive direct impact on the Intention to Use Mobile Commerce Applications.**

5.2.4 INTENTION TO USE M-COMMERCE

This aims at capturing the individual’s willingness to undertake a specific action (behavior). The Intention to Use can be found in most of the IT adoption theories, it has been defined by (Venkatesh, Morris et al. 2003) as “The degree to which a person has formulated conscious plans to perform or not perform some specified future behavior.”

This leads to the fourth hypotheses:

> **H4: The “Intention to Use” Mobile Commerce applications has a positive direct impact on the Reported Usage.**

5.2.5 Attitude Towards M-Commerce

This construct has been found to be the most important predictor of behavioral intentions in some cases, while also been found not to yield significant impact on intentions when performance and effort expectancies have been included in the models (Venkatesh, Morris et al. 2003; Lars 2005).

In this research model, Attitude will be added to capture the users overall attitude through Perceived Price of Service, Frequency of Mobile Usage, Perceived Enjoyment and the Mobile Device Affinity.

The fifth hypotheses will be:

> **H5: Attitude towards Mobile Commerce has a positive direct impact on the Intention to Use Mobile Commerce applications.**

5.2.6 The Perceived Price Of The Service

The financial sacrifice given in return for a service plays a role in developing an intention towards the mobile services. Previous research identified a negative relation with the price of service and the Intention to Use mobile services(Wu and Wang 2005).

The sixth and the seventh hypotheses are:

> **H6. Price of Service has a negative direct impact on the "Intention to Use" Mobile Commerce applications.**
>
> **H7. Price of Service has a negative direct impact on the Attitude towards Mobile Commerce.**

5.2.7 The Frequency Of Mobile Usage

The more a user is exposed to the new technology the more this user is willing to adopt the direct channels like Mobile Commerce applications (Lohse and Bellman 2000). As the mobile

penetration rates are high in Palestine (and as the usage rates are increasing; the researcher suggests involving this construct in the study.

The eighth and the ninth hypotheses are:

H8. Frequency of Use has a positive direct impact on the Attitude towards Mobile Commerce.

H9. Frequency of Use has a positive direct impact on the Intention to Use Mobile Commerce applications.

5.2.8 Perceived Enjoyment

Since the Mobile Commerce can also serve as an entertainment medium beside the utilitarian one, the Perceived Enjoyment will be included as a construct; this comes from the research of (van der Heijden 2004) as he proposed this construct as an extension to the original TAM while testing the usage patterns of a Dutch movie portal. He defined it as:"Perceived Enjoyment specifies the extent to which fun can be derived from using the system as such".

The tenth and the eleventh hypotheses are

H10. The Perceived Enjoyment has a positive direct impact on the Attitude towards Mobile Commerce.

H11. The Perceived Enjoyment has a positive direct impact on the Intention to Use Mobile Commerce applications.

5.2.9 Mobile Affinity

The closer the relation between the individual and the medium, the greater the probability to use the device for commercial transaction as suggested by (Ball-Rokeach 1985)

The twelfth and the thirteenth hypotheses are:

H12. The Mobile Affinity has a positive direct impact on the Attitude towards Mobile Commerce

H13. The Mobile Affinity has a positive direct impact on the Intention to Use Mobile Commerce applications.

5.3 MODERATOR EFFECTS

5.3.1 AGE

The younger users have a more salient effect on the Attitude, that is what (Venkatesh and Morris 2000) argued and presented. Also in the introduction of the UTAUT by (Venkatesh, Morris et al. 2003) they reviewed earlier IS research which included age as a mediator, it was found that the Age plays an important role in influencing the subjective norm (in this research it is called : Social Influence).

Based on that, the fourteenth hypotheses is

H14. The Age exerts a moderator effect on the Mobile Commerce adoption model

5.3.2 EXPERIENCE

Experience as a moderator has been researched and introduced in most of the IS adoption theories, it was included in the theory of planned behavior (Ajzen 1985). As discussed by (Taylor and Todd 1995), the experience plays an important role in IS adoption, they suggested that inexperienced users place different emphasis on the determinants of intention and usages. Experience was also part of combined TAM-TPB, theory of reasoned action, TAM2, model of PC Utilization and innovation diffusion theory (Fishbein 1975; Venkatesh and Davis 2000; Venkatesh, Morris et al. 2003).

Based on the above, it is expected that experienced users will have different behavior than the inexperienced users, from there the fifteenth hypotheses is:

H15. The Experience will exert a moderator effect on the Mobile Commerce adoption model.

5.3.3 GENDER

The gender has been addressed as a moderator in TAM2 where (Venkatesh and Morris 2000) presented the impact of Gender as part of the Social Influence on the Intention to Use. The same has been done in many studies related to the adoption of IS systems (Venkatesh, Morris et al. 2003) and in the Mobile Commerce adoption field (Carlsson, Carlsson et al. 2006). Several studies reported that males had significantly more positive attitude toward computers than females did (Economides and Grousopoulou 2008).

In this research, the researcher decided to study the differences that may appear through gender and so the sixteenth hypotheses is:

H16. The Gender will exert a moderator effect on the Mobile Commerce adoption model.

PART FOUR:

THE EMPIRICAL PART

A "deduction" approach will be adopted where hypotheses will be tested. The research design shall be based conclusively on primary survey data collected at one point of time through a questionnaire administrated survey with randomly selected sample. Later ON, the data will be analyzed using the structural equation modeling and the multivariate analysis of variance.

This part consists of four chapters; the first concentrates on the operationalization of the constructs, the second handles the data collection process from questionnaire design to actual collection process, the third chapter provides general analysis of the sample. the last chapter presents the testing phase; this chapter is split into five main sections, where the first section presents the testing of the original model, the second section presents the exploratory research phase. The third section presents the confirmatory phase. The fourth section presents a rescaling method to be used for model estimation, where the fifth and the last section present the effects of the moderators.

6 OPERATIONLISATION OF THE CONSTRUCTS

The collection tool (a two pages questionnaire) included many measures for each of the constructs discussed in the previous chapter, most of them stem from previous research in similar fields; of course some minor changes has to be applied to reflect the nature of the research. These measures were originally in English, due to the fact that the questionnaire is to be conducted in Arabic, professional translation by an authorized translator with adequate knowledge in social sciences has been conducted.

As the research model is stemming from the UTAUT, it still includes some original items from the UTAUT itself that originated from traditional information system adoption theories, these original constructs find their roots in other theories as will be presented in this chapter.

6.1 UTAUT ORIGINAL CONSTRUCTS

Three Original constructs from the UTAUT can be found in this modified research Model:

The **Performance Expectancy** is measured using four items stemming from perceived usefulness from (Davis 1989) and the Relative Advantage from (Moore and Benbasat 1991) some of these items were already altered to suite the Mobile Services by (Carlsson, Carlsson et al. 2006) the other items that were not altered have been modified by the researcher to suite the mobile service context.

The **Effort Expectancy** is measured using three items stemming from the Perceived Ease of Use from Technology Acceptance Model by (Davis 1989). Since these Items were originally developed for information systems, alteration is done by the researcher to reflect the mobile services context.

The **Social Influence** is captured through the image construct from the Innovation Diffusion Theory (Moore and Benbasat 1991) and through the subjective norm that can be found in the research of (Fishbein 1975; Davis 1989; Taylor and Todd 1995). As in the case of the items in the "Effort Expectancy" construct and some of the items in "Performance Expectancy" construct the researcher has altered the Items to reflect the Mobile Services context rather than the IS context as it was meant originally by the Items.

The **Behavioral Intention** is measured by the three items stemming from most of the intention models (Fishbein 1975; Ajzen 1985; Davis 1989; Venkatesh and Davis 1996; Venkatesh and Davis 2000). The adopted three items were altered to meet the Mobile Services context by (Carlsson, Carlsson et al. 2006; Yi-Shun, Hsin-Hui et al. 2006).

6.2 NON-UTAUT ORIGINAL CONSTRUCTS

There are another six constructs that do not belong to the UTAUT, these constructs come from different environments but all were related to the information system adoption and specifically from the Mobile Services adoption research.

The **Attitude** is captured using three Items from the latest research on Mobile services done by (Carlsson, Carlsson et al. 2006), these items were altered by (Carlsson, Carlsson et al. 2006) from their original information system context to meet the Mobile Services one.

The **Perceived Financial Resources** is captured by using three items from the research of (Yi-Shun, Hsin-Hui et al. 2006) , these three Items were altered to meet the concept of mobile services.

The **Frequency of Use** is captured through five questions where the participants in the survey will answer these questions with a number representing number of calls made, number of calls received, number of SMS sent, number of MMS sent and the average amount of monthly expenditure on mobile phone bill.

The **Perceived Enjoyment** is measured by three Items, referring to the original research done by (van der Heijden 2004) these three items have been modified to meet the mobile services context by (Shin 2007).

The **Mobile Affinity** is measured through four items capturing the User attachment to the device, this is stemming from the research of (Ball-Rokeach 1985) and has been modified to meet the Mobile Devices prospective by (Wehmeyer 2008).

6.3 MODERATORS

Three moderators exist in the model; Age, the first one is being captured by asking the respondents how old they are, the same applies for gender. As for the Experience, it is captured through asking the respondents to cross check the mobile services they used as they are provided with a list of all available mobile services. Their response will indicate the user familiarity with the mobile services.

Table 12 - Constructs

Construct	# of Items	Scale used	Operationlisation	Source
Performance Expectancy	4	categorical	1=totally agree 6= totally disagree	(Davis, Bagozzi et al. 1989; Moore and Benbasat 1991; Carlsson, Carlsson et al. 2006)
Effort Expectancy	3	categorical	1=totally agree 6= totally disagree	(Davis 1989)
Social Influence	2	categorical	1=totally agree 6= totally disagree	(Fishbein 1975; Davis 1989; Taylor and Todd 1995)
Intention to Use Mobile Service	3	categorical	1=totally agree 6= totally disagree	(Fishbein 1975; Ajzen 1985; Davis 1989; Venkatesh and Davis 1996; Venkatesh and Davis 2000) (Carlsson, Carlsson et al. 2006; Yi-Shun, Hsin-Hui et al. 2006)
Attitude towards Mobile services	3	categorical	1=totally agree 6= totally disagree	(Davis, Bagozzi et al. 1989; Carlsson, Carlsson et al. 2006)
Price Of Service	3	categorical	1=totally agree 6= totally disagree	(Yi-Shun, Hsin-Hui et al. 2006)
Frequency of Mobile Use	5		1= yes 2=no 3= I don't know	
Perceived Enjoyment	3	categorical	1=totally agree 6= totally disagree	(van der Heijden 2004) (Shin 2007)
Mobile Device Affinity	4	categorical	1=totally agree 6= totally disagree	(Ball-Rokeach 1985; Wehmeyer 2008)
Moderator : Age	1	scale	open	(Venkatesh, Morris et al. 2003)
Moderator : Gender	1	categorical	1= male 2=female	(Venkatesh, Morris et al. 2003)
Moderator : Experience	15	categorical	1=yes 2=no	(Venkatesh, Morris et al. 2003)

Source: own presentation

7 DATA COLLECTION PROCESS

In social sciences, and specifically if the research is quantitative in nature like this one, there are many methods used to collect data as to contribute to the science knowledge, some use exploratory approach and others use a conclusive one, the later approach is used in this research where a survey data is collected from various locations at one point of time.

This chapter will include a demonstration of the questionnaire design and the actual data collection.

7.1 QUESTIONNAIRE DESIGN

The questionnaire was developed according to the general marketing research guidelines in line with the requirements of the analytical software (Mplus) that will be used on a later stage.

The questionnaire was developed to be easy to fill, as "the questionnaire filler" has to only check a box that best represents his / her answer or opinion, this approach has minimized the amount of missing data. Another characteristic of the questioner was its shortness, as it could be filled within seven minutes since the questionnaire was printed on a two A4 pages. A pilot test has been conducted in May 2008 in a seminar session at the Vienna University of Economics and Business (WU), where 17 colleagues and fellow researchers filled the questionnaire and gave their comments and remarks; using this feedback, the researcher reshaped the questionnaire and came up with the final version.

The collection tool captured two sets of data, the first one is general relating to demographics and the second one is model specific where the 30 items (questions) were answered capturing the meaning of nine constructs. The questioner is presented below:

Vienna University Of Economics and Business Administration
Summer 2008

Dear Participant,

Mobile Commerce is an innovative way of capitalizing on the everywhere any time concept! Part of this is the m-services which are defined as enhanced information services accessed while mobile like news, weather, financial services etc. where you have directly/indirectly to pay for the service
Please take a few minutes to fill in this questioner, your opinion is highly valued and the information will remain anonymous.

Thanks in advance!!

1 Do you have mobile Phone?	Yes ☐ No ☐
2 Since when you have your current device:	Years _____
3 How many mobile phones you have?	1 ☐ 2 ☐ 3 ☐ More: _____
4 What carriers you have :	Jawwal ☐ Pelephone ☐ Celcom ☐ Orange ☐ Mirs ☐
5 What mobile Phone you have?	Nokia ☐ Sony Ericsson ☐ Motorola ☐ Samsung ☐ LG ☐ other : _____
6 Does your mobile have a :	Color screen ☐ Camera ☐ Wifi ☐ Bluetooth ☐
7 How many calls you make / receive per day?	More than 15 ☐ Between 10-15 ☐ Less than 5 ☐ Few times a week ☐
8 What is your average bill per month?	NIS: _____
9 How many SMS you sent per day	Per Day : _____
10 How may MMS you sent per month	Per Month: _____
11 Have you heard before about mobile commerce?	Yes ☐ No ☐ I don't know ☐
12 Is you mobile Phone capable of conducting mobile commerce activities?	Yes ☐ No ☐ I don't know ☐
13 Did you ever subscribed for a mobile internet services i.e. WAP before?	Yes ☐ No ☐ I don't know ☐
14 If yes, are you still subscribed?	Yes ☐ No ☐ I don't know ☐
15 Did you ever buy or sell products over the internet?	Yes ☐ No ☐ I don't know ☐

16 From the Following Services I Use :
Logos ☐ Monophonic and Polyphonic Ring Tones ☐ Information services ☐ Vote services (SMS) ☐
Songs download ☐ Videos download ☐ SMS for prize draws ☐ Others

Please Flip the Page.....

Vienna University Of Economics and Business Administration
Summer 2008

Please Check the box responding to your beliefs

	Totally Agree					Totally Disagree
17 Overall. I find mobile services useful in my daily life	1	2	3	4	5	6
18 Using mobile services is fixable , since it can be used anytime and anywhere	1	2	3	4	5	6
19 Using mobile services saves me time and effort in performing tasks	1	2	3	4	5	6
20 Using Mobile services increases my productivity	1	2	3	4	5	6
21 Learning how to use the Mobile services will be easy for me	1	2	3	4	5	6
22 I learn easily how to employ new technologies (e.g. GPRS,WAP, Bluetooth).	1	2	3	4	5	6
23 It is easy to get mobile services working for me	1	2	3	4	5	6
24 I am trendy while using mobile services.	1	2	3	4	5	6
25 My friends and family think that I should use mobile services	1	2	3	4	5	6
26 I am among the first ones who adopt new technologies	1	2	3	4	5	6
27 Assuming that I have access to mobile services, I intend to use them	1	2	3	4	5	6
28 I want my mobile device to be the latest model	1	2	3	4	5	6
29 I want to try the latest mobile technologies	1	2	3	4	5	6
30 Financial resource (e.g. to pay for communication time, subscription, and/or service) is not a barrier for me in using mobile services.	1	2	3	4	5	6
31 I have enough financial resources (e.g. to pay for communication time, subscription, and/or service) for using mobile services.	1	2	3	4	5	6
32 I enjoy using mobile services	1	2	3	4	5	6
33 When I am browsing the internet on my mobile I don't feel the time passing by	1	2	3	4	5	6
34 If my mobile is out of coverage, I feel that I am disconnected	1	2	3	4	5	6
35 If my mobile battery is empty I try to find a way to charge it.	1	2	3	4	5	6
36 I feel lost without my mobile	1	2	3	4	5	6
37 I don't go anywhere without my mobile	1	2	3	4	5	6
38 I can stay for few days without my mobile	1	2	3	4	5	6

39 Gender Male ☐ Female ☐

40 Age Years _____

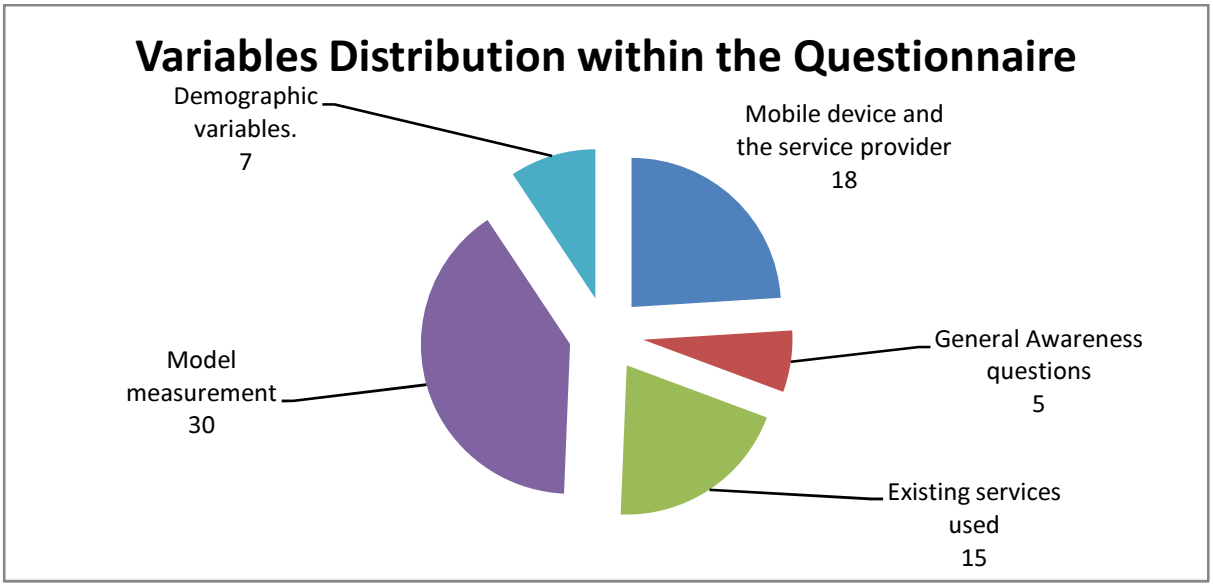
41 Living location Town ☐ Refuge camp ☐ Village ☐

42 Do you have a fixed line at : Home Yes ☐ No ☐ Work Yes ☐ No ☐

Please Flip the Page.....

The collection tool included 48 questions that generated 75 variables, these variables were grouped in five main groups; 18 related to mobile device and the service provider, five general awareness questions, 15 on existing services used, 30 for the model measurement and seven demographic variables.

Figure 20 - Collection Tool - Variables Distribution



Source: own presentation

7.2 The Sampling & The Data Collection

7.2.1 The Sampling

The target population of this study is the Palestinian market and to be specific the West Bank market. Three major universities have been approached and agreed to help in collecting the information, also the federations of the Chambers of Commerce agreed to help in collecting the information from the businessmen through their nine locations spread along the West Bank.

The distribution of the collection locations guarantees the geographical randomization up to a great extent and limits the randomization of profession to only business people and

students. The three major collections sites were the universities that are distributed geographically as follows:

South: Hebron Technical University: HTTP://www.ppu.edu

Middle: Bethlehem University: HTTP://www.bethlehem.edu

North: Birzeit University: HTTP://www.birzeit.edu

As the Collected data will be processed using structural equation methods implemented through the "Mplus" software by Muthén and Muthén, their guidelines will be used in relation to sample size, which is more than 200.

7.2.2 The Data Collection

Before starting the actual collection of the data, details and explanations on how to fill the questioner were given by the researcher to the responsible person at the universities (i.e. public relation officer) and to the receptionist at the Chambers of Commerce sites; these details and explanations were given in person as to eliminate any distortion in the message or unclear understanding of any of the questioner elements.

The actual collection took place under administrated conditions; in the case of the students, the lecturers distributed the questioner to their students before the lecture is over and asked them to fill it out and return it on their way out of the lecture room, in the case of the Chambers of Commerce, business people who were waiting to receive services were approached by the receptionist asking them if they are interested to take part in filling this questionnaire; if agreed; they give it back to the receptionist as soon as they finished filling it out.

As for the total number of cases collected, the researcher asked from each collection location to collect as many as possible within a time frame of two weeks (last week of July 2008 through first week of august 2008).

The final collected cases are shown in Table 13 below:

Table 13 - Collected Cases Locations

Location	Number of Cases
Bethlehem University	264
Birzeit University	263
Chamber of Commerce	169
Hebron University	399
Total	1095

8 GENERAL ANALYSIS

In this chapter, general analysis will be conducted covering response rates, sample structure, comparison between users and none users and the data preparation for the structural model measurement.

8.1 RESPONSE RATE

A total of 1095 questionnaires were collected during the collection period, from these 1095; 31 cases were excluded from the analysis as the respondents have answered “No” for the question: *Do you have a mobile Phone?* The rest of the cases were accepted and adopted for the analysis.

Collection of the data has taken place in nine different locations, below is Table 14 showing the distribution of the collected questionnaires in terms of accepted cases and rejected cases.

Table 14 - Distribution of Collected Questionnaires

Location	Do you have a mobile Phone? (YES)	Do you have a mobile Phone? (NO)
Bethlehem University	255	9
Birzeit University	261	2
Chamber of Commerce - Bethlehem center	37	0
Chamber of Commerce - south Hebron center	12	0
Chamber of Commerce - Salfit center	29	3
Chamber of Commerce - Qalqilya center	15	0
Chamber of Commerce - Mix of locations	53	4
Hebron University	386	13
Chamber of Commerce - Hebron City	16	0
Total	1064	31

As noticed from the distribution above, more than 75% of the respondents who answered "NO" are located within the universities sample where the questionnaires were distributed for all students that attended a specific lecture, this allows to predict the penetration rate of mobile Phones among the university students which is found to be 97.4% way much higher than the general penetration rate among the Palestinian population as reported by the PCBS at slightly less than 50%.

8.2 SAMPLE STRUCTURE

The sample is dominated by the university students, with an average age of 22.5 years and around two thirds of the sample lives in urban areas. Below is Table 15 showing the major demographical characteristics of the sample:

Table 15 - Major Demographical Characteristics of the Sample

Gender			**Living location**	
MISSING	2.7%		MISSING	3.1%
MALE	48.6%		TOWN	67.2%
FEMALE	48.7%		VILLAGE	2.7%
			REFUGEE CAMP	27.0%
Occupation				
MISSING	4.5%		**Age**	
BUSINESS MAN	3.8%		MISSING	60
MERCHANT	4.1%		Mean	22.5
EMPLOYEE	9.7%		Minimum	16
STUDENT	74.6%		Maximum	70
OTHER	3.3%		Percentile 25	19
			Percentile 50	20
			Percentile 75	22

As the respondents were asked: “what mobile services they used”, a profiling of users and none users could be made, the definition of a “mobile services user” is captured through the total number of applications used. From the whole sample, the mean of total applications used were 2.65.

Also there were a remarkable number of respondents that they did not use any application, those reflect the none-users, below is Table 16 reflecting the major characteristics of the none-users group which is comprised of 269 cases:

Table 16 - Characteristics Of The None-Users Group

Gender			**Living location**	
MISSING	5.6%		MISSING	6.3%
MALE	42.7%		TOWN	64.7%
FEMALE	51.7%		VILLAGE	1.1%
			REFUGEE CAMP	27.9%
Occupation				
MISSING	8.9%		**Age**	
BUSINESS MAN	2.6%		MISSING	27
MERCHANT	3.3%		Mean	24
EMPLOYEE	13.4%		Minimum	16
STUDENT	68.4%		Maximum	68
OTHER	3.4%		Percentile 25	19
			Percentile 50	20
			Percentile 75	22

The remainder of the sample comprised 795 cases, in this sample at least one mobile service application has been used; the distribution of the mobile applications used shows a mean of 3.55 applications. Below is Table 17 showing the distribution of the applications used among the users sample:

Table 17 - Mobile Applications Used - Users Sample

Total applications used	
Missing	0
Mean	3.55
Minimum	1
Maximum	15
Percentile 25	2.00
Percentile 50	3.00
Percentile 75	5.00

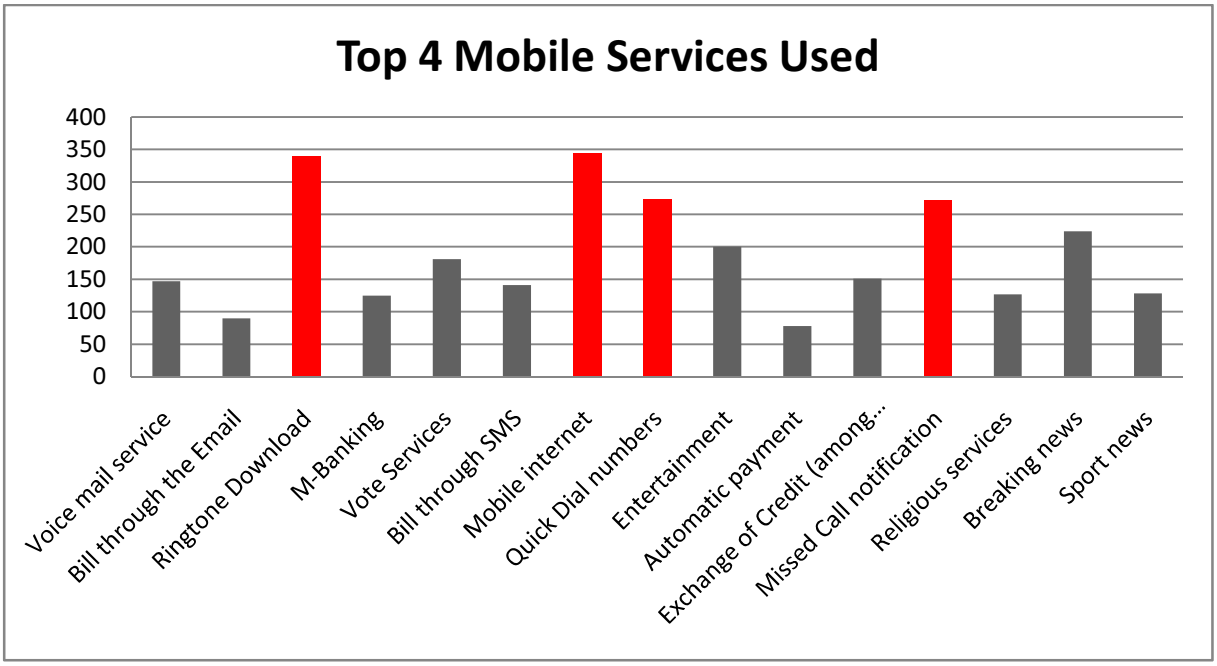
The demographics of the users group show that the users are averaging 2.2 years younger than the "non-users". Table 18 below shows more detailed information about the demographics of the "non-users" sample:

Table 18 - Demographics - Non-Users

Gender			**Living location**	
MISSING	1.7%		MISSING	2.0%
MALE	50.6%		TOWN	68.0%
FEMALE	47.7%		VILLAGE	3.3%
			REFUGEE CAMP	26.7%
Occupation				
MISSING	3.0%		**Age**	
BUSINESS MAN	4.2%		MISSING	33
MERCHANT	4.4%		Mean	22.2
EMPLOYEE	8.4%		Minimum	16
STUDENT	76.7%		Maximum	70
OTHER	3.3%		Percentile 25	19
			Percentile 50	20
			Percentile 75	22

When it comes to the kind of applications used, the domination of entertainment applications was clear, ringtone downloads and the mobile internet are the most used applications. Another interesting application is the missed call notification and the quick Dial numbers have been also heavily used among the sample though not belonging to the entertainment realm, this is justified by the fact that these services are free of charge; which supports previous hypotheses saying that financial sacrifice plays a role in adopting and using mobile services.

Figure 21- Mobile Services Used



Source: own presentation

When it comes to the mobile fleet specifications, the total number of devices owned by the population of the sample is 1189 since around 24.6% of the respondents reported that they have more than one mobile device. The average device age was found to be 3.02 years with domination of Nokia over the rest of the brands. Below is Table 19 describing the mobile devices fleet properties:

Table 19 - Mobile Devices Fleet Properties

Device Age (years)			***Device Brand***	
Missing	68		Nokia	73.4%
Mean	3.02		LG	1.1%
Minimum	0.1		Motorola	13.8%
Maximum	18		Samsung	6.9%
Percentile 25	1		Sony-Ericsson	3.4%
Percentile 50	2		Others	1.3%
Percentile 75	4			
Mobile Carrier			***Device Specifications***	
Jawwal	63.6%		Color screen	90.2%
Pelephone	2.8%		Camera	81.2%
Celcom	18.4%		WiFi	31.0%
Orange	14.2%		Bluetooth	74.4%
Mirs	1.0%			
Number of Devices owned by one person				
One Device	72.6%			
Two Devices	19.3%			
3 or More Devices	5.4%			
Missing	2.8%			

In addition, it seems that having an advanced device with rich multimedia capable hardware is something desired among the sample; as most of the devices studied in the sample have a color screen, camera and a Bluetooth.

8.3 Comparison Between Users And Non-Users

When the two groups were compared in addition to the demographics described in the above section, other characteristics have been found to be different for example; some were related to their use behavior, expenditure, the mobile service connectivity specifications and to users' general awareness of mobile services and commerce.

8.3.1 Usage Behavior & Awareness Level

There is a limited array of services offered in the market covering the basic services like ringtone downloads, information delivery, voting services and so on. The most used services are the mobile internet and the ringtone download. Below in Table 20 is a list of all of the services and the percentage of respondents that used it:

Table 20 - Services Used

Service	Percent of respondents that use this application
Mobile internet	32.3%
Ringtone Download	31.9%
Quick Dial numbers	25.7%
Missed Call notification	25.5%
Breaking news	21.1%
Entertainment	18.8%
Vote Services	17.0%
Exchange of Credit (among prepaid users)	14.2%
Voice mail service	13.8%
Bill through SMS	13.3%
Sport news	12.0%
Religious services	11.9%
M-Banking	11.7%
Bill through the Email	8.5%
Automatic payment	7.3%

It was found that the users group spent almost doubles the amount of money on their monthly bill also they make almost the double amount of calls as shown in Table 21 below:

Table 21 - Usage & Expenditure

	Mean	
	Users	**Non-Users**
How many calls do you make per day?	12.3 calls per day	6.8 calls per day
What is your average bill per month?	203.4 NIS* per Month	126.8 NIS* per Month 5

* NIS = New Israeli Shekel, at the time of collecting the data a 1 NIS was equal to 18.5 Euro cents.

More conventional mobile usage is naturally influencing the overall bill, but also shows the higher tendency to use none traditional mobile services and applications.

On the awareness level, the users group showed a remarkable higher awareness towards their mobile device capabilities and the Mobile Commerce / Electronic Commerce in general. Below is Table 22 showing the differences:

Table 22 - Awareness of Mobile Device Capabilities

	Users		Non-Users	
	YES	**NO**	**YES**	**NO**
Have you heard before about Mobile Commerce?	56.3%	43.7%	34.1%	65.9%
Is your mobile Phone capable of conducting Mobile Commerce activities?	72.7%	27.5%	51.0%	49.2%
Did you ever buy or sell products over the internet?	12.9%	86.6%	5.1%	93.4%

As noticed in the demographic distribution of the sample, two dominant demographic groups could be found; the first one is the students that accounts for three quarters of the sample and the rest are business people. These two groups have also different expenditure behaviors as well as different gender and age distribution.

Earlier studies (DeBaillon and Rockwell 2005) showed that there are some differences in usage behavior of mobiles between men and women. The analysis of the sample showed similar results while demonstrating the difference in mobile usage behavior through gender, the sample will be split into two groups the students and the non-students as demonstrated in Table 23 below:

Table 23 - Mobile Usage Behavior

	Complete sample			Students			Non-students		
	M	**F**	**Total**	**M**	**F**	**Total**	**M**	**F**	**Total**
Mobile phone usage level									
How many calls do you make per day? (**call / day)**	13.16	8.45	10.8	10.27	8.51	9.23	18.73	8.46	19.91
What is your average bill per month? ***(NIS / Month)***	243.88	125.68	186.29	159.23	121.4	137	391.82	173.75	353.71
Mobile Commerce awareness									
Have you heard before about Mobile Commerce?**(yes)**	57.6%	42.4%	100%	49.4%	50.6%	100%	88%	12%	100%
Is your mobile phone capable of conducting Mobile Commerce activities? **(yes)**	51.7	48.3	100%	44.3%	55.7%	100%	81.8%	18.2%	100%
Did you ever buy or sell products over the internet? **(yes)**	75.9%	24.1%	100%	71.3%	28.8%	100%	87.1%	12.9%	100%

8.4 DATA PREPARATION FOR MODEL MEASUREMENT

All the direct indicators were measured on a 6-point likert scale ranging from 1 = totally agree to 6 = totally disagree, this 6-points scale was used intentionally to avoid any central tendency of responses.

The 6 points scale dataset gave the researcher the flexibility to present the data for the model estimation in three different ways, the first one as a categorical (ordinal) scale , the second as an interval scale though this approach has raised great controversy among researchers but it became widely adopted (KNAPP 1990; Jamieson 2004), the third approach will be used on a later stage of this chapter where the 6 points scale will be rescaled and

transferred to a dichotomies scale as to demonstrate the impact of data treatment effect on the structural and the measurement model estimates.

After cleaning up the data and eliminating the rejected cases using SPSS, codes were given to the variables as to reduce the longer names into some acronyms that will be used in the input programming language of the Mplus, the acronyms will be used further on in this chapter as to refer to the constructs, latent variables they represent. Below is Table 24 showing the full name of each acronym:

Table 24 - Acronyms Used In Mplus Input

No.	Acronym	Full name
1	ATT	Attitude toward Mobile Commerce
2	IN	Intention to Use upcoming Mobile Commerce applications
3	PE	Performance Expectancy
4	EE	Effort expectance
5	SI	Social Influence
6	ENJ	Perceived Enjoyment
7	FS	Perceived price of service
8	MA	Mobile Device affinity
9	FOU	The frequency of usage.
10	USE	The Reported Use

8.4.1 Rescaling Into Dichotomies Scales

One of the main advantages of rescaling the six categories into dichotomies is to reduce the categorical thresholds from five thresholds to one threshold. This will also allow for more degrees of freedom in measuring the model that will result in a better data-parameter ratio. On the other hand, the Binary data do not comprehensively represent the point of view of the respondents.

The result of reducing the numbers of thresholds to one is a substantial reduction of the amount of time Mplus would have needed to estimate the structural model, it will also allow using the more robust full information ML estimator.

It is expected that this reduction from the six points scale to the dichotomies one will result in diminishing the amount of noise in the data to better reflect to the actual values intended by the respondents.

The switch to the Binary code was done by calculating the median for each observed indicator and then splitting the scale into two parts at the median; the first part should be equal or less than the median and the second part should be greater than the median.

The split points are shown for each indicator in Table 25 below:

Table 25 - Cut Points - Dichotomies Scale

No.	Indicator name	Mean	Median
1	PU01	1.91	1
2	PU02	2.13	2
3	PU03	1.97	2
4	PU04	2.54	3
5	PEU01	2.01	2
6	PEU02	2.14	2
7	PEU03	2.39	2
8	SI01	3.33	3
9	SI02	2.86	3
10	IN01	3.28	3
11	IN02	2.50	3
12	IN03	2.33	2
13	AT01	2.58	2
14	AT02	2.35	2
15	AT03	2.97	3
16	FS01	3.07	3
17	FS02	2.44	2
18	FS02R	4.20	5
19	FS03	2.99	3
20	PE01	2.76	3
21	PE02	3.17	3
22	PE03	2.84	3

Table 25 - Cnt'd

No.	Indicator name	Mean	Median
23	MA01	2.62	2
24	MA02	2.62	2
25	MA03	2.27	2
26	MA04	3.79	4
27	MA04R	2.85	3

8.4.2 Other Data Treatments

There were some minor changes made to the data as to better fit within the whole data set, one of these was to reverse scale some indicators; the indicators FS02 and MA04 were reversed as they were initially reverse questions, showing negative indicators compared to the rest of the indicators, the reversed version of the indicator is identified by the letter "R", i.e. MA04 when reversed becomes MA04R.

Another change to the data has been done to the frequency of usage indicators; the FOU05 has been discarded from the analysis as almost half of the respondents answered with a "zero" as they were asked: "How may MMS do you sent per month". The rest of the indicators were grouped into three categories representing high usage with the value of three, moderate usage with the value of two and low usage with the value of one. Table 26 below gives more information about the cut off points:

Table 26 - Cut Points - FOU

Indicator name	Unit	Low usage	Moderate usage	High usage
FOU01	Calls	0 up to 4	Bigger than 4 up to 10	More than 10
FOU02	Calls	0 up to5	Bigger than 5 up to 10	More than 10
FOU03	Monetary ($)	0 up to 50	Bigger than 50 up to 150	More than 150
FOU04	SMS	0 up to 2	Bigger than 2 up to 5	More than 5

After preparing the data for the analysis, it was randomly split into two groups, the first dataset included 506 cases and will be used for testing the initial model and for the

exploratory part of the analysis while the second dataset includes 572 cases and will be used later on to test the findings from the exploratory phase.

As the Questioner was filled manually this resulted in having some missing values, these has been re-coded into (-1) and will be handled by Muthén and Muthén estimators within the Mplus statistical program.

Along the process of preparing the data two main programs have been used to administrate and to analyze the data, the first one is SPSS and the second is Mplus where the latter one was used for analyzing the measurement and structural relations in the model.

8.4.3 MPLUS AND THE ESTIMATORS

As mentioned earlier, the Mplus statistical software will be used to estimate the structural and the measurement models. This software is among the best ones available in the market and the version used in this research is 5.2 that were released in 2008. For more information about Mplus, the website http://www.statmodel.com provides comprehensive details about it.

While using Mplus, a decision on some issues has to be made, the most prominent decision is which estimator to use? And in which shape to present the data?

The Maximum likelihood and the Weighted least Squares are the choices for the estimator in the case at hand; choosing one of them has to take into consideration the data presentation as it might limit the choice of the estimator.

Using the data as collected and treating it as categorical data will limit the choice of estimator to the WLSMV, as using the ML estimator, which requires numerical integration, gets heavy whenever the number of categorical variables gets above three or four variables. In the case at hand there are nine continues latent variables identified through 29 dependent categorical variables, so using the ML is not feasible when the data is treated as categorical. Therefore, if the data are to be used as categorical, the choice of the WLSMV is to be made; using the WLSMV will produce large numbers of thresholds that will influence

the degrees of freedom and therefore the credibility and interpretability of the tested model.

If the data presented in binary form both the ML and the WLSMV can be used but with some restrictions on the uses of the ML, the WLSMV can be used without any restrictions as it is the default estimator for such a case. Using the ML estimator is not a straightforward process. It has to be specified in the Mplus programming language that these binary presentation of the data is not categorical but a continuous one; still a continuous presentation of a binary dataset is practically a categorical one; in this case the ML can be used.

If the data to be presented in a scale (interval) form, also both of the estimators can be used, but still with some restrictions. The ML is used in a direct way, as it is the default estimator by Mplus. The WLMV can be used only if there are no missing data, which is not the case at hand; minimum full sample size to proceed with the estimation in the case at hand is 464 where the available full sample size is 338. This eliminates the chance of using the WLSMV estimator with when the data presented in a scale (interval) form. Below is Table 27 illustrating the estimators and the type of data they can handle:

Table 27 - Estimators

Estimator	**Data presentation**		
	6 intervals (continues)	**6 categories**	**dichotomous**
WLS	Possible with no missing data.	Default estimator, possible with missing data	Default estimator, possible with missing data
ML	Default estimator, possible with missing data	Possible even with missing data - numerical integration is required, with more than 4 variables specified as categorical; the estimation becomes almost impossible.	Possible even with missing data - numerical integration is required, with more than 4 items specified as categorical; the estimation becomes almost impossible.

Source: (Muthén 2010)

8.4.3.1 ESTIMATORS AND DATA

Many studies and researchers discussed this issue of estimators and which one to Choose, according to (Olsson, Foss et al. 2000) “The ML is considerably more insensitive to variations in sample size and kurtosis. Only empirical fit is affected by specification error—as it should be. Moreover, ML tends in general not only to be more stable, but also demonstrates higher accuracy in terms of empirical and theoretical fit compared to the other estimators”.

When it comes to the WLS, it requires well-specified models and requires a large sample to perform well and appears to reward the researcher for using none-normal data and results in a better empirical fit (Olsson, Foss et al. 2000).

There is no specific estimator to be favored over the others, as this was and still is an issue of discussion among the researchers. The distribution of the data is to be considered when choosing the estimator (DiStefano 2002), in the case at hand the data has a non-normal distribution and in this case the ML estimator can be used when the skewness is moderate and the sample size is bigger than 1000 (Muthen, B et al. 1985) , which is not the case here as the sample size is 506. On the next page is Table 28 showing the kurtosis estimate for the data, ML has been recommended for use if item-level Characteristic are approximately normal where a Kurtosis value of <|1.0| is acceptable (Muthen, B et al. 1985; DiStefano 2002).

The researcher decided not to favor one estimator over the other, but to use both of them whenever possible; the recommendation of (Olsson, Foss et al. 2000) is to apply more than one estimator and make a cross check, this approach will be adopted in this research where both the ML and the WLS will be used with different variations of data presentations.

Table 28 - Kurtosis

Item	Kurtosis	Accepted range <|1.0|
PU01	0.630	within recommended range
PU02	0.375	within recommended range
PU03	0.850	within recommended range
PU04	-0.532	within recommended range
PEU01	0.317	within recommended range
PEU02	0.665	within recommended range
PEU03	-0.396	within recommended range
SI01	-1.058	almost on recommended range
SI02	-0.920	within recommended range
IN01	-0.940	within recommended range
IN02	-0.456	within recommended range
IN03	-0.375	within recommended range
AT01	-0.521	within recommended range
AT02	-0.378	within recommended range
AT03	-1.046	almost on recommended range
FS01	-1.012	almost on recommended range
FS02	-0.428	within recommended range
FS03	-0.796	within recommended range
PE01	-0.453	within recommended range
PE02	-1.129	out of recommended range
PE03	-0.694	within recommended range
MA01	-0.900	within recommended range
MA02	-0.666	within recommended range
MA03	-0.433	within recommended range
MA04	-1.436	out of recommended range
FOU01C	-1.254	out of recommended range
FOU02C	-1.541	out of recommended range
FOU03C	-1.356	out of recommended range
FOU04C	-1.540	out of recommended range

The statistical software used in this research implements both estimators, the results will be crosschecked to see which relations in the structural model have managed to stay significance while using both estimators and different data presentations.

9 THE STRUCTURAL MODELING ANALYSIS

As recommended by (Anderson and Gerbing 1988) the original data collected will be split into two datasets; the first dataset will be used to test the initial hypotheses and develop the alternative model and the second dataset will be used to validate the solution obtained from the first part.

To test the hypotheses presented in earlier sections and for the development of new models, causal modeling will be used and specifically structural equation modeling; for this purpose the Mplus software will be used as a confirmatory and hypotheses testing tool.

In the case at hand the whole sample contains 1064 observations which allow for a large enough samples where each of the two datasets contains more than 500 observations, that exceed the minimum of 200 observations recommended by Muthén and Muthén and the 150 by (Anderson and Gerbing 1988). These relative large sample sizes allow for using the full-information estimator ML and the WLSMV estimator. As mentioned earlier, the WLSMV is recommended for usage when the data are presented as categorical.

The following chapter (chapter nine) will be organized as follows:

Testing the Original Model

1. Subsection one presenting the ***first dataset*** in a categorical form, the WLSMV estimator will be used to estimate both, the structural and the measurement models.
2. Subsection two presenting the ***first dataset*** in continuous (interval) form; the ML estimator will be used. It is also possible to use the WLSMV estimator only if there are no missing values in the dataset, which is not the case at hand.
3. Subsection three presenting the ***first dataset*** in dichotomous (binary) form, the WLSMV estimator will be used as well as the ML estimator.

The exploratory phase

1. Subsection one presenting the ***first dataset*** in a categorical form, the WLSMV estimator will be used to estimate both, the structural and the measurement models.

2. Subsection two, presenting the ***first dataset*** in continuous (interval) form; the ML estimator will be used to estimate both, the structural and the measurement models.

The confirmatory phase

1. Subsection one presenting the ***second dataset*** in a categorical form, the WLSMV estimator will be used to estimator both, the structural and the measurement models.

2. Subsection two, presenting the ***second dataset*** in continuous (interval) form; the ML estimator will be used to estimator both, the structural and the measurement models.

Alternative approaches

Part four shall present a method of rescaling the data within the open source statistical software "R" using the package "lineales", where a correlation matrix will be created and used in Mplus with the ML estimator as to re-test the final model resulting from part one again with a different approach to re-scaling and to re-validate the relations implied.

Group analysis

Group analysis will be conducted to test the 14^{th}, 15^{th} and 16^{th} hypotheses. Below are the grouping variables:

- Age
- Gender
- Experience

10 THE TESTING PHASE

During the testing, exploratory and confirmatory phases, the researcher will adopt a specific format for presenting the test results; this is to avoid any repetition of accepted standards and measurements intervals. The following sequence and structure will be used to present the structural and measurement part of each test in this chapter.

10.1 THE STRUCTURAL MODEL PART

In this part the researcher presents a table showing the test of model fit, below is Table 29 showing the fit indices and their recommended values:

Table 29 - Fit Indices Recommended Values

Fit index	Estimator	Recommended value
CFI (Comparative Fit Index)	ML & WLSMV	≥0.90 (Reisinger and Mavondo 2007)
TLI (Tucker-Lewis Index)	ML & WLSMV	≥0.90 (Reisinger and Mavondo 2007)
RMSEA	ML & WLSMV	≤0.8 (Hu and Bentler 1999; Daire Hooper 2008)
WRMR	WLSMV	Close to one (Yu 2002)
SRMR	ML	≥0.08 (Hu and Bentler 1999)

The recent studies recommend stricter measures on the acceptable levels for a good model fit but still an RMSEA between 0.08 and 0.10 represents a mediocre fit (Robert C. MacCallum 1996). As for the SRMR, the latest trend is to use a 0.05 as cut off point (Daire Hooper 2008) .

After presenting the model fit measures, a graph is presented indicating the relations among the latent variables. The standardized factor loadings are indicated on the arrows specifying the measurement relations; a p-value at a confidence level of 0.95 is adopted along the whole testing phase. Following that, the researcher shows a table displaying the hypothesized relations, nature of the hypothesized influence, factor loadings, critical ratios, p-values and specifying what was rejected or supported.

10.2 THE MEASUREMENT MODEL PART

The scales used in the data collection tool stems from various scientific literatures. As per the recommendation of (Cenfetelli and Bassellier 2009) the measurement model is to be estimated without the structural relations as to avoid any possible interpretational confounding; this interpretational confounding has been identified by (Burt 1976) as :

> *"INTERPRETATIONAL CONFOUNDING OCCURS WHEN THE EMPIRICAL MEANING ASSIGNED TO AN UNOBSERVED VARIABLE DIFFERS FROM THE MEANING ASSIGNED TO THAT VARIABLE BY THE RESEARCHER PRIOR TO ESTIMATING THE UNKNOWN PARAMETERS."*

Thus, the measurement model will be evaluated while ignoring the structural part; just by testing the causal relations among the measurement items and the latent variables.

Presenting the measurement model part starts with showing the model fit indices with the same arguments as in the structural one above, after that the researcher discusses the reliability and the convergent validity through presenting a table containing the means, standard deviation, factor loading and composite reliability for each item in the model along with the average variance extracted for each latent variable.

The accepted values for these criteria varies from one researcher to another, but in generally a factor loading and a composite Reliability of 0.6 or more represents a good measure and an average variance extracted of 0.5 or more is also a good measure (Bagozzi and Youjae 1988). Bolds represent values that did not manage to achieve the minimum requirement.

The discriminant validity is established when the square of the correlation of two constructs is less than the average variance extracted estimates of the two constructs (Fornell and Larcker 1981; Bagozzi and Youjae 1988) this is being calculated and presented in a table containing the squared correlations and the AVE on the diagonal. Bolds represent values that did not manage to reach the minimum requirement.

Along the coming tests, the standardized results of the Mplus will be used to allow comparability among models.

10.3 TESTING THE ORIGINAL MODEL

As described in the data treatment section earlier, the data set has been split into two datasets, the first dataset that consists of 506 observations shall be used to test the initial model and for the development of the exploratory model as well.

The initial model included 12 hypotheses; these were tested using Mplus. In the first dataset used, there were 19 cases with missing data on all model indicators, those were eliminated automatically by Mplus from the estimation process, the rest of the missing data were handled by Mplus and the WLSMV or the ML estimators which found a 89 different missing data patterns.

10.3.1 DATA PRESENTED AS CATEGORICAL

As the data was collected through a Likert scale, it could be presented in a categorical form for estimation in the Mplus. The WLSMV is the default estimator in such cases where the data contains missing values, the ML estimator can be used if the data contain few categorical items (usually less than four variables presented in categorical form) if it contains more than that, the estimation process using the ML estimator becomes almost impossible as it requires numerical integration which is a very resource intensive procedure.

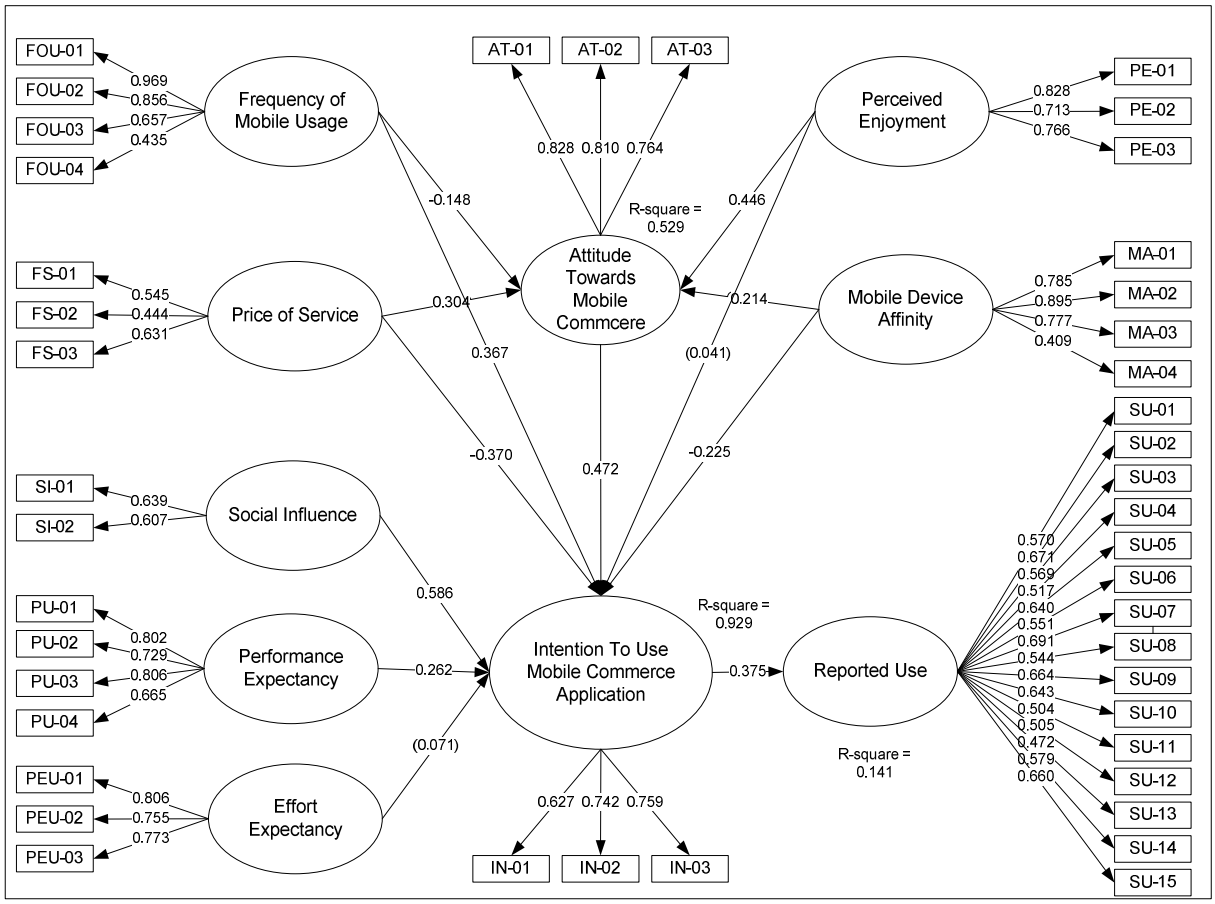
The test of model fit did not demonstrate a superb fit but still all indices outperformed the recommended levels; the model fit results from the Mplus are presented in Table 30 below:

Table 30 - Initial Model Testing - Fit Indices for Structural Model - Categorical Data - WLSMV

Fit index	Recommended Value	Value	Comment
CFI (Comparative Fit Index)	≥0.90	0.916	Almost on accepted range
TLI (Tucker-Lewis Index)	≥0.90	0.940	Within accepted range
RMSEA	≤0.08	0.060	Within accepted range
WRMR	Close to 1.0	1.299	Within accepted range

The testing results are indicated in Figure 22 below, loading coefficients for insignificant paths (p-value > 0.05) are presented within two brackets. On the structural relation level, testing of the Original Model resulted in relatively good results, as nine of the hypotheses were accepted and only four were rejected. For a comprehensive overview of the Mplus testing results refer to appendix 1.

Figure 22 - Initial Model- Structural Relations - Categorical Data - WLSMV



As illustrated in the graph above, not all of the hypotheses were supported, but still the model represented a good absolute measure fit through the RMSEA and the TLI that were within the accepted ranges. The test result supported nine out of thirteen hypotheses where the strongest determinant of the Intention to Use Mobile Commerce was the Attitude; this is in-line with earlier research conducted in the field of technology acceptance for mobile applications; the second strongest determinant for the Intention to Use is the Frequency of Use. The third strongest determinant was found to be the Social Influence, which is in line with earlier research as well. In addition, the Performance Expectancy and the Perceived Price of Service were found to have a significant effect on the Intention to Use. The Mobile

Affinity is found to have a negative significant influence on the Intention to Use; this is in contrary to the original hypotheses that suggested a positive relation.

The Perceived Enjoyment and the Effort Expectancy were found to have no significant influence on the Intention to Use.

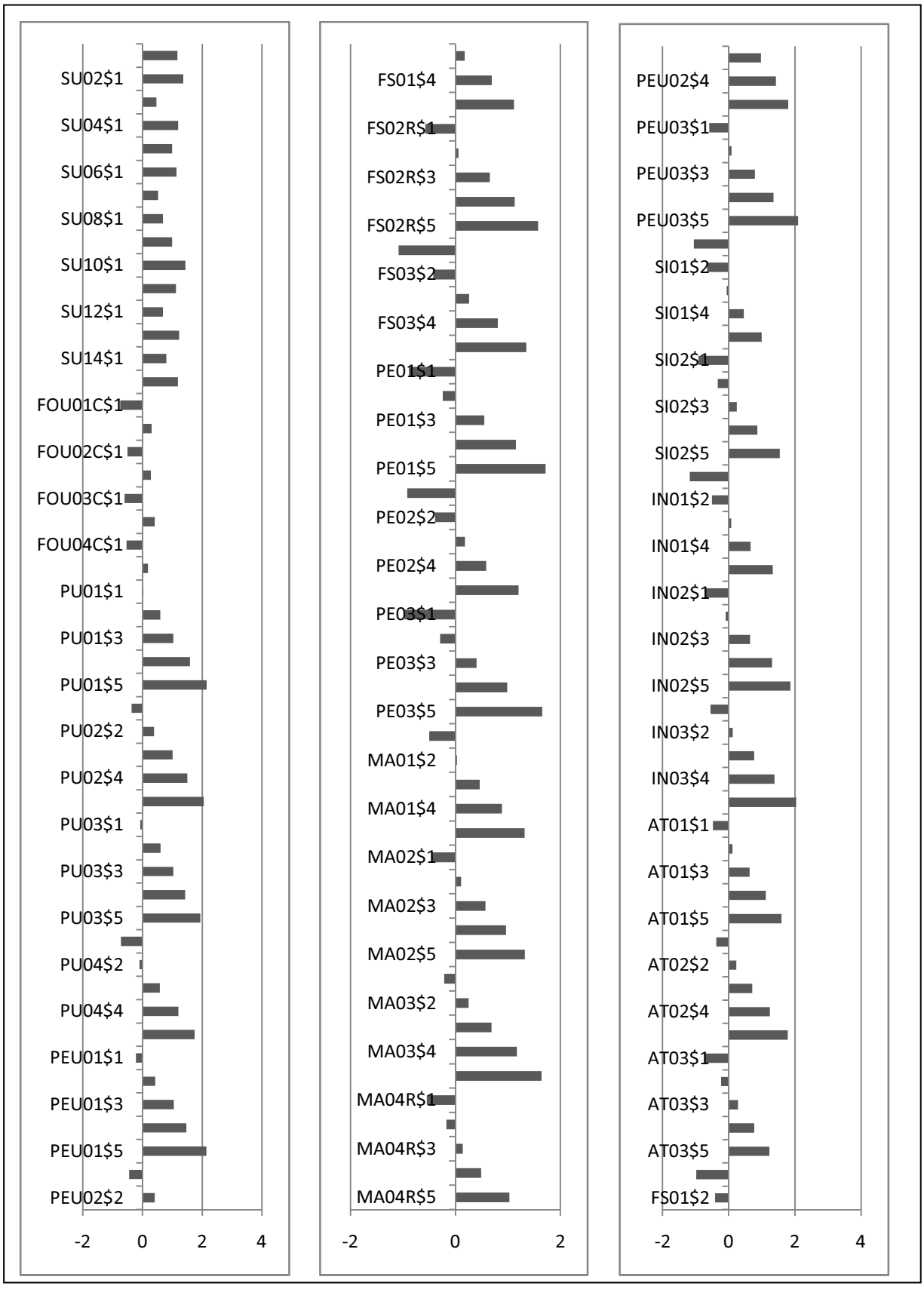
All the hypothesized relations have been found to generate a significant influence on The Attitude Towards Mobile Commerce, the strongest is the Perceived Enjoyment and the second strongest are the Mobile Affinity and the Perceived Financial Sacrifice, the least significant was found to be the Frequency of Usage; it reported a negative significant influence contradicting the hypothesized positive influence. Table 31 lists the hypotheses test results for the initial model using the categorical dataset and the WLSMV estimator.

Table 31 - Initial Model Testing - Structural Model Relations - Categorical Data - WLSMV

	Hypotheses	Path Coefficient	Critical ratio	Two Tailed P-Value	Supported/Rejected
1	Performance Expectancy on the Intention to Use - "**+**"	0.262	2.316	0.021	Supported
2	Effort Expectancy on the Intention to Use - "**-**"	0.071	0.572	0.567	Rejected
3	Social Influence on the Intention to Use - "**+**"	0.586	2.877	0.004	Supported
4	Perceived Price of Service on the Intention to Use - "**-** "	-0.370	-2.301	0.021	Supported
5	Frequency of Use on the Intention to Use - "**+**"	0.367	3.718	0	Supported
6	The Perceived Enjoyment on the Intention to Use - "**+**"	0.041	0.245	0.807	Rejected
7	The Mobile Affinity on the Intention to Use - "**+**"	-0.225	-3.232	0.001	Rejected
8	Attitude on Intention to Use - "**+**"	0.472	6.277	0	Supported
9	Perceived Price of Service on the Attitude - "**-**"	0.304	4.09	0	Supported
10	Frequency of Use on the Attitude - "**+**"	-0.148	-2.465	0.014	Rejected
11	The Perceived Enjoyment on the Attitude - "**+**"	0.446	7.921	0	Supported
12	The Mobile Affinity on the Attitude - "**+**"	0.214	4.105	0	Supported
13	The Intention to Use on the Reported Use - " **+ "**	0.375	6.521	0	Supported

Since the data were presented in a categorical form, the WLSMV estimator created thresholds that will be used in both of the structural model and the measurement estimations. These thresholds showed some negative values in order to simulate a normal distribution that is necessary for the Mplus estimation. More about the thresholds and their representing values can be seen in the appendix 1 and in the graph below:

Figure 23 - Initial Model Testing - Thresholds



Another matter to be considered when testing causal models is the discriminate validity and reliability of the measurement model; this is discussed in the following subchapter.

10.3.1.1 TEST OF THE MEASUREMENT MODEL

The measurement model will be evaluated while ignoring the structural part; just by testing the causal relations among the measurement items and the latent variables. The total number of the measurement items in the initial model is 44.

The model fit indices are acceptable; as all the reported four indices were within the recommended range. Below they are presented in Table 32:

Table 32- Initial Model Testing - Fit Indices For Measurement Model - Categorical Data - WLSMV

Fit index	Recommended Value	Value
CFI (Comparative Fit Index)	≥0.90	0.933
TLI (Tucker-Lewis Index)	≥0.90	0.953
RMSEA	≤0.08	0.053
WRMR	Close to 1	1.181

The reliability, composite reliability and the average variance extracted is calculated and presented in Table 33 below:

Table 33 - Initial Model Testing - Reliabilities - Categorical Data - WLSMV

Construct	Item	Mean	Std.dev.	Factor	CR	AVE
USE	SU01	0.12	0.33	**0.58**	0.89	**0.35**
	SU02	0.09	0.28	0.69		
	SU03	0.32	0.47	**0.55**		
	SU04	0.12	0.32	**0.54**		
	SU05	0.16	0.37	0.64		
	SU06	0.13	0.33	**0.55**		
	SU07	0.30	0.46	0.67		
	SU08	0.25	0.43	**0.54**		

Table 33 - Cnt'd

Construct	Item	Mean	Std.dev.	Factor	CR	AVE
	SU09	0.16	0.37	0.66		
	SU10	0.08	0.26	0.66		
	SU11	0.13	0.34	**0.52**		
	SU12	0.25	0.43	**0.51**		
	SU13	0.11	0.31	**0.47**		
	SU14	0.21	0.41	**0.59**		
	SU15	0.12	0.32	0.65		
PE	PU01	1.99	1.28	0.80	0.84	0.57
	PU02	2.23	1.26	0.73		
	PU03	2.06	1.33	0.81		
	PU04	2.74	1.39	0.67		
EE	PEU01	2.16	1.28	0.81	0.82	0.61
	PEU02	2.29	1.31	0.76		
	PEU03	2.51	1.31	0.77		
SI	Si01	3.60	1.62	0.64	**0.56**	**0.39**
	Si02	3.11	1.48	0.61		
FS	FS01	3.30	1.60	**0.57**	**0.59**	**0.33**
	FS02	2.64	1.48	**0.45**		
	FS03	3.22	1.48	0.67		
FOU	FOU01	2.03	0.97	0.97	0.84	0.58
	FOU02	1.97	1.01	0.85		
	FOU03	1.73	1.21	0.67		
	FOU04	2.02	1.01	**0.46**		
ENJ	PE01	2.87	1.35	0.84	0.82	0.61
	PE02	3.29	1.63	0.72		
	PE03	3.00	1.40	0.77		
MA	MA01	2.78	1.66	0.78	0.82	0.55
	MA02	2.68	1.63	0.90		
	MA03	2.40	1.53	0.78		
	MA04R	3.18	1.85	**0.41**		
IN	IN01	3.39	1.49	0.62	0.76	0.52
	IN02	2.68	1.34	0.75		

Table 33 - Cnt'd

Construct	Item	Mean	Std.dev.	Factor	CR	AVE
	IN03	2.48	1.32	0.77		
ATT	AT01	2.59	1.51	0.83	0.84	0.64
	AT02	2.44	1.44	0.81		
	AT03	3.07	1.64	0.76		

The measurement tool performed pretty well, all items presented acceptable reliability except for the Social Influence and the Perceived Price of Service indicators that failed to reach the minimum requirements for the average variance extracted and the composite reliability.

As for the convergent validity some indicators failed to reach the minimum factor loading of more than 0.6, those are presented in bold fonts in Table 33.

Table 34 presents the AVE on the diagonal and the squares of the inter-variable correlation, there is a good level of discriminant validity and only two Items appeared not to fulfill the criteria explained earlier, the first one is the Social Influence, this was expected as the Social Influence indicators in the collection tool were only two; this was a clear drawback in the design of the collection tool as at least three indicators should be used. The second one is the Intention to Use Mobile Services; this construct was measured by three items and satisfied the minimum requirement for the structural and the measurement model. Still it is worth to re-evaluate the collection tool regarding the Intention to Use to find out the potentials for improvement.

Table 34 - Initial Model Testing - Discriminant Validity - Categorical Data - WLSMV

Construct	USE	PE	EE	SI	FS	FOU	ENJ	MA	IN	ATT
USE	0.35									
PE	0.05	0.57								
EE	0.00	0.56	0.61							
SI	0.08	0.23	0.15	**0.39**						
FS	0.06	0.17	0.13	0.30	0.33					
FOU	0.19	0.05	0.01	0.06	0.20	0.58				
ENJ	0.11	0.22	0.22	0.49	0.21	0.03	0.61			
MA	0.00	0.26	0.18	0.15	0.12	0.01	0.18	0.55		
IN	0.11	0.38	0.29	0.63	0.19	0.05	0.51	0.14	**0.52**	
ATT	0.04	0.19	0.22	0.44	0.17	0.01	0.36	0.23	0.54	0.64

10.3.2 DATA PRESENTED AS DICHOTOMIES

One of the main advantages of presenting the data in a binary form is the reduction of the thresholds from five to one (in this specific case), but also this procedure affects the interpretability of the full information collected.

Both of the estimators ML and the default estimator WLSMV can be used in this case. The WLSMV will be used where the data is defined as categorical. The ML will be used where the dichotomies data is defined at continuous; since the data is represented in the form of zeros and ones, handling it as a "continuous data" by the ML estimator should have the same impact as handling it as a categorical, this is used to bypass the numerical integration process that the ML estimator requires and in this case making the estimation impossible.

The changes to the data necessary to transfer it into a dichotomies form were discussed in an earlier section, below in Table 35 are the changes done to the frequency of usage as to transfer it from a continues scale into a dichotomies form:

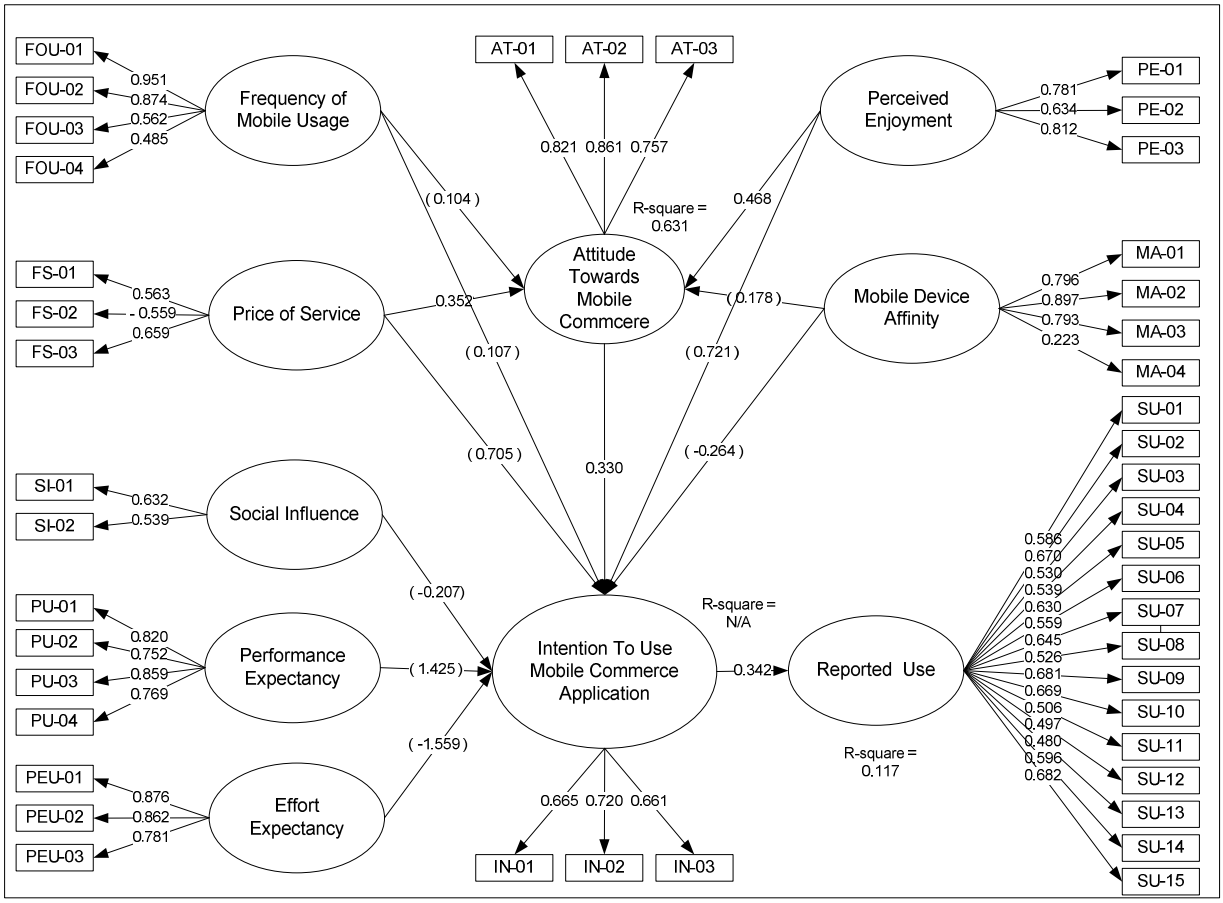
Table 35 - Rescaling the FOU into Dichotomies Form

	FOU01	FOU02	FOU03	FOU04
Cut points	5.00	8.00	100.00	3.00

10.3.2.1 TREATMENT WITH THE WLSMV ESTIMATOR

The results of testing the structural relations using the binary representation of the data through the WLSMV estimator, showed a noticeable difference compared to the categorical presentation in the last subchapter, the main changes could be seen in the number of hypotheses to be confirmed and the model fit indices. The structural relation test did not provide complete results as the R square for the Intention to Use could not be calculated. This makes the model un-interpretable. For the sake of demonstrating the effect of the binary data presentation processed with the WLSMV estimator, Figure 24 presents the structural relations test and the factor loadings:

Figure 24 - Initial Model- Structural Relations - Dichotomies Data – WLSMV



The model fit indices showed a satisfying model fit on all measurement levels. Still this does not mean that the model is interpretable.

Table 36 - Initial Model Testing - Fit Indices for Structural Model - Dichotomies Data - WLSMV

Fit index	Recommended Value	Value	Comment
CFI (Comparative Fit Index)	≥0.90	0.906	Within accepted range
TLI (Tucker-Lewis Index)	≥0.90	0.922	Within accepted range
RMSEA	≤0.08	0.044	Within accepted range
WRMR	Close to 1	1.178	Within accepted range

Most of the hypothesized relations were rejected, in total only four hypothesized relations were supported out of thirteen as can be seen in Table 37 on next page.

Table 37 - Initial Model Testing - Structural Model Relations - Dichotomies Data - WLSMV

	Hypotheses	Path Coefficient	Critical ratio	Two Tailed P-Value	Supported /Rejected
1	Performance Expectancy On the Intention to Use - "**+**"	**1.425**	**0.762**	**0.446**	**Rejected**
2	Effort Expectancy on the Intention to Use - "**-**"	**-1.559**	**-0.524**	**0.600**	**Rejected**
3	Social Influence on the Intention to Use - "**+**"	**-0.207**	**-0.062**	**0.950**	**Rejected**
4	Perceived Price of Service on the Intention to Use - "**-**"	**0.705**	**0.297**	**0.767**	**Rejected**
5	Frequency of Use on the Intention to Use - "**+**"	**0.107**	**0.105**	**0.917**	**Rejected**
6	The Perceived Enjoyment on the Intention to Use - "**+**"	**0.721**	**0.276**	**0.782**	**Rejected**
7	The Mobile Affinity on the Intention to Use - "**+**"	**-0.264**	**-0.966**	**0.334**	**Rejected**
8	Attitude on Intention to Use - "**+**"	0.330	1.971	0.049	Supported
9	Perceived Price of Service on the Attitude - "**-**"	0.352	3.177	0.001	Supported
10	Frequency of Use on the Attitude - "**+**"	**0.104**	**1.369**	**0.171**	**Rejected**
11	The Perceived Enjoyment on the Attitude - "**+**"	0.468	4.781	0.000	Supported
12	The Mobile Affinity on the Attitude - "**+**"	**0.178**	**1.913**	**0.056**	**Rejected**
13	The Intention to Use on the Reported Use - " **+ "**	0.342	5.731	0.000	Supported

10.3.2.1.1 TEST OF THE MEASUREMENT MODEL - WLSMV

When testing the measurement model, as expected, the binary representation of the data coupled with the WLSMV estimator reported excellent model fit indices that all were within the accepted range; below they are presented in Table 38:

Table 38 - Initial Model Testing - Fit Indices for Measurement Model - Dichotomies Data - WLSMV

Fit index	Recommended Value	Value
CFI (Comparative Fit Index)	≥0.90	0.929
TLI (Tucker-Lewis Index)	≥0.90	0.943
RMSEA	≤0.08	0.038
WRMR	Close to 1	1.075

Also, as expected the Binary representation of the data coupled with the WLS estimator reported remarkably good measurement results. Below is Table 39 showing the reliability and convergent validity parameters:

Table 39 - Initial Model Testing - Reliabilities - Dichotomies Data - WLSMV

Construct	Item	Mean	Std.dev.	Factor	CR	AVE
USE	SU01	0.12	0.33	**0.59**	0.89	**0.35**
	SU02	0.09	0.28	0.68		
	SU03	0.32	0.47	**0.51**		
	SU04	0.12	0.32	**0.55**		
	SU05	0.16	0.37	0.63		
	SU06	0.13	0.33	**0.56**		
	SU07	0.30	0.46	0.64		
	SU08	0.25	0.43	**0.54**		
	SU09	0.16	0.37	0.66		
	SU10	0.08	0.26	0.69		
	SU11	0.13	0.34	**0.51**		
	SU12	0.25	0.43	**0.50**		
	SU13	0.11	0.31	**0.47**		
	SU14	0.21	0.41	0.61		
	SU15	0.12	0.32	0.68		
PE	PU01	0.15	0.36	0.82	0.88	0.64
	PU02	0.15	0.36	0.75		
	PU03	0.15	0.36	0.86		

Table 39 - Cnt'd

Construct	Item	Mean	Std.dev.	Factor	CR	AVE
	PU04	0.27	0.45	0.77		
EE	PEU01	0.15	0.35	0.88	0.88	0.71
	PEU02	0.17	0.37	0.87		
	PEU03	0.21	0.41	0.78		
SI	Si01	0.53	0.50	0.63	**0.51**	**0.34**
	Si02	0.40	0.49	**0.54**		
FS	FS01	0.43	0.50	**0.59**	**0.22**	**0.39**
	FS02	0.26	0.44	**0.57**		
	FS03	0.40	0.49	0.70		
FOU	FOU01	0.49	0.50	0.95	0.83	0.56
	FOU02	0.46	0.50	0.87		
	FOU03	0.40	0.49	**0.59**		
	FOU04	0.46	0.50	**0.49**		
ENJ	PE01	0.29	0.45	0.80	0.81	0.58
	PE02	0.43	0.50	0.65		
	PE03	0.34	0.47	0.83		
MA	MA01	0.32	0.47	0.79	0.80	0.53
	MA02	0.28	0.45	0.90		
	MA03	0.24	0.43	0.80		
	MA04R	0.44	0.50	**0.22**		
IN	IN01	0.46	0.50	0.67	0.75	0.50
	IN02	0.25	0.44	0.74		
	IN03	0.21	0.41	0.70		
ATT	AT01	0.26	0.44	0.82	0.85	0.66
	AT02	0.24	0.43	0.86		
	AT03	0.38	0.49	0.76		

Most of the items presented acceptable reliability except for the Social Influence and the Perceived Price of Service indicators that failed to reach the minimum requirements for the average variance extracted and the composite reliability.

The same is with the convergent Validity as SI02,FS01,FS02,FOU03,fOU04,MA04R and many of the USE indicators failed to reach the minimum factor loading of more than 0.6.

As for the discriminant validity, the measurement tool did not perform in a good way; this was expected as much of the information is being lost when the conversion to the binary scale takes place. Below is Table 40 showing the average variance extracted on the diagonal:

Table 40 - Initial Model Testing - Discriminant Validity - Dichotomies Data - WLSMV

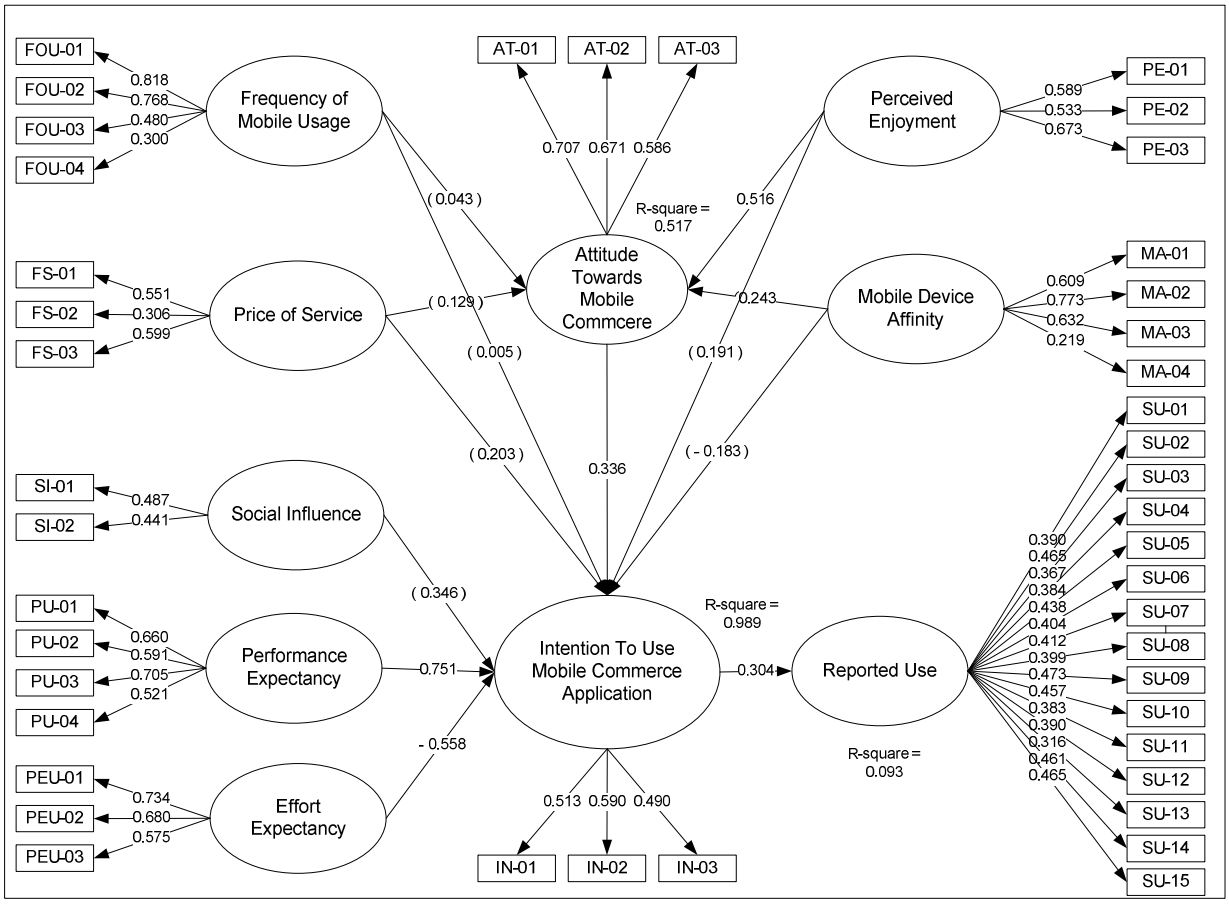
Construct	USE	PE	EE	SI	FS	FOU	ENJ	MA	IN	ATT
USE	**0.35**									
PE	0.03	**0.64**								
EE	0.00	0.76	**0.71**							
SI	0.08	0.21	0.25	**0.34**						
FS	0.08	0.16	0.26	0.38	**0.39**					
FOU	0.22	0.02	0.00	0.05	0.10	0.56				
ENJ	0.09	0.27	0.31	0.61	0.26	0.03	**0.58**			
MA	0.00	0.23	0.23	0.25	0.17	0.01	0.21	0.53		
IN	0.10	0.48	0.30	0.78	0.38	0.04	0.60	0.17	**0.50**	
ATT	0.04	0.21	0.35	0.72	0.29	0.02	0.42	0.28	0.61	**0.66**

The binary representation of the dataset showed that that tool needs a comprehensive revaluation. The researcher will discuss this in a coming chapter where the results across the different data presentations and the estimators chosen are compared and conclusions are inferred.

10.3.2.2 TREATMENT WITH THE ML ESTIMATOR

The ML estimator is used here were the binary data presentation is treated as a scale; testing the structural model resulted in accepting additional two hypotheses compared to handling the dataset with the WLSMV estimator.

Figure 25 - Initial Model - Structural Relations - Dichotomies Data - ML



Still some observations can be made with regard to treating the data as binary and using the ML estimator; starting with the fit indices, the model seems neither to provide superior nor bad fit indices values, below in Table 41 is a presentation of the indices:

Table 41 - Initial Model Testing - Fit Indices For Structural Model - Dichotomies Data - ML

Fit index	Recommended Value	Value	Comment
CFI (Comparative Fit Index)	≥0.90	0.858	Almost on accepted range
TLI (Tucker-Lewis Index)	≥0.90	0.845	below accepted range
RMSEA	≤0.08	0.036	Within accepted range
SRMR	≤0.08	0.057	Within accepted range

As for the hypothesized relations, not all of them were confirmed; in total, there are six hypothesized relations supported out of thirteen as seen in Table 42 below.

Table 42 - Initial Model Testing - Structural Model Relations - Dichotomies Data - ML

	Hypotheses	Path Coefficient	Critical ratio	Two Tailed P-Value	Supported/Rejected
1	Performance Expectancy On the Intention to Use - "**+**"	0.751	3.653	0.000	Supported
2	Effort Expectancy on the Intention to Use - "**-**"	-0.558	-2.377	0.017	Supported
3	Social Influence on the Intention to Use - "**+**"	0.346	0.816	0.415	**Rejected**
4	Perceived Price of Service on the Intention to Use - "**-**"	0.203	1.122	0.262	**Rejected**
5	Frequency of Use on the Intention to Use - "**+**"	0.005	0.063	0.950	**Rejected**
6	The Perceived Enjoyment on the Intention to Use - "**+**"	0.191	0.584	0.559	**Rejected**
7	The Mobile Affinity on the Intention to Use - "**+**"	-0.183	-1.698	0.090	**Rejected**
8	Attitude on Intention to Use - "**+**"	0.366	3.441	0.001	Supported
9	Perceived Price of Service on the Attitude - "**-**"	0.129	1.180	0.238	**Rejected**
10	Frequency of Use on the Attitude - "**+**"	0.043	0.713	0.476	**Rejected**
11	The Perceived Enjoyment on the Attitude - "**+**"	0.516	6.007	0.000	Supported
12	The Mobile Affinity on the Attitude - "**+**"	0.243	3.578	0.000	Supported
13	The Intention to Use on the Reported Use - " **+ "**	-0.304	-5.288	0.000	Supported

10.3.2.2.1 TEST OF THE MEASUREMENT MODEL - ML

When testing the measurement model, as expected, the binary representation of the data coupled with the ML estimator reported quite good model fit indices; as half of them were within the accepted range; below they are presented in Table 43:

Table 43 - Initial Model Testing - Fit Indices for Measurement Model - Dichotomies Data - ML

Fit index	Recommended Value	Value	Comment
CFI (Comparative Fit Index)	≥0.90	0.869	Below accepted range
TLI (Tucker-Lewis Index)	≥0.90	0.856	Below accepted range
RMSEA	≤0.08	0.035	Within accepted range
SRMR	≤0.08	0.051	Within accepted range

The test of the scales properties in terms of reliability, convergent validity and discriminant validity resulted in completely different outcomes when using the ML estimator compared to the WLSMV. It shows a low level of reliability, convergent validity and discriminant validity on most of the items. Unaccepted values are presented in bold font in Table 44 below:

Table 44 - Initial Model Testing - Reliabilities - Dichotomies Data - ML

Construct	Item	Mean	Std.dev.	Factor	CR	AVE
USE	SU01	0.12	0.33	**0.39**	0.76	**0.17**
	SU02	0.09	0.28	**0.47**		
	SU03	0.32	0.47	**0.36**		
	SU04	0.12	0.32	**0.39**		
	SU05	0.16	0.37	**0.44**		
	SU06	0.13	0.33	**0.40**		
	SU07	0.30	0.46	**0.42**		
	SU08	0.25	0.43	**0.40**		
	SU09	0.16	0.37	**0.47**		
	SU10	0.08	0.26	**0.46**		
	SU11	0.13	0.34	**0.38**		
	SU12	0.25	0.43	**0.39**		
	SU13	0.11	0.31	**0.31**		
	SU14	0.21	0.41	**0.46**		
	SU15	0.12	0.32	**0.46**		
PE	PU01	0.15	0.36	0.66	0.71	**0.39**

Table 44 - Cnt'd

Construct	Item	Mean	Std.dev.	Factor	CR	AVE
	PU02	0.15	0.36	**0.59**		
	PU03	0.15	0.36	0.71		
	PU04	0.27	0.45	**0.52**		
EE	PEU01	0.15	0.35	0.73	0.70	**0.44**
	PEU02	0.17	0.37	0.69		
	PEU03	0.21	0.41	**0.57**		
SI	Si01	0.53	0.50	**0.52**	**0.36**	**0.22**
	Si02	0.40	0.49	**0.41**		
FS	FS01	0.43	0.50	**0.55**	**0.26**	**0.26**
	FS02	0.26	0.44	**-0.29**		
	FS03	0.40	0.49	0.62		
FOU	FOU01	0.49	0.50	0.82	0.70	**0.40**
	FOU02	0.46	0.50	0.76		
	FOU03	0.40	0.49	**0.49**		
	FOU04	0.46	0.50	**0.31**		
ENJ	PE01	0.29	0.45	0.60	0.64	**0.38**
	PE02	0.43	0.50	**0.54**		
	PE03	0.34	0.47	0.70		
MA	MA01	0.32	0.47	0.61	0.66	**0.36**
	MA02	0.28	0.45	0.77		
	MA03	0.24	0.43	0.63		
	MA04R	0.44	0.50	**0.22**		
IN	IN01	0.46	0.50	**0.49**	**0.56**	**0.30**
	IN02	0.25	0.44	0.62		
	IN03	0.21	0.41	**0.53**		
ATT	AT01	0.26	0.44	0.69	0.69	**0.43**
	AT02	0.24	0.43	0.68		
	AT03	0.38	0.49	**0.59**		

As for the discriminant validity the measurement tool did not perform in a good way at all; below is Table 45 showing the average variance extracted on the diagonal:

Table 45 - Initial Model Testing - Discriminant Validity - Dichotomies Data - ML

Construct	CR	USE	PE	EE	SI	FS	FOU	ENJ	MA	IN	ATT
USE	0.76	**0.17**									
PE	0.71	0.01	**0.39**								
EE	0.70	0.00	0.66	**0.44**							
SI	**0.36**	0.07	0.11	0.13	**0.22**						
FS	**0.26**	0.08	0.06	0.10	0.38	**0.26**					
FOU	0.70	0.16	0.01	0.01	0.04	0.06	0.40				
ENJ	0.64	0.06	0.18	0.21	0.54	0.22	0.02	**0.38**			
MA	0.66	0.00	0.15	0.16	0.20	0.09	0.00	0.16	0.36		
IN	**0.56**	0.06	0.40	0.22	0.60	0.30	0.03	0.54	0.13	**0.30**	
ATT	0.69	0.02	0.15	0.24	0.57	0.15	0.00	0.38	0.23	0.55	**0.43**

10.3.3 DATA PRESENTED AS A SCALE

As argued and presented in earlier parts of this dissertation, treating the Likert scales as an interval has became a common practice among researchers.

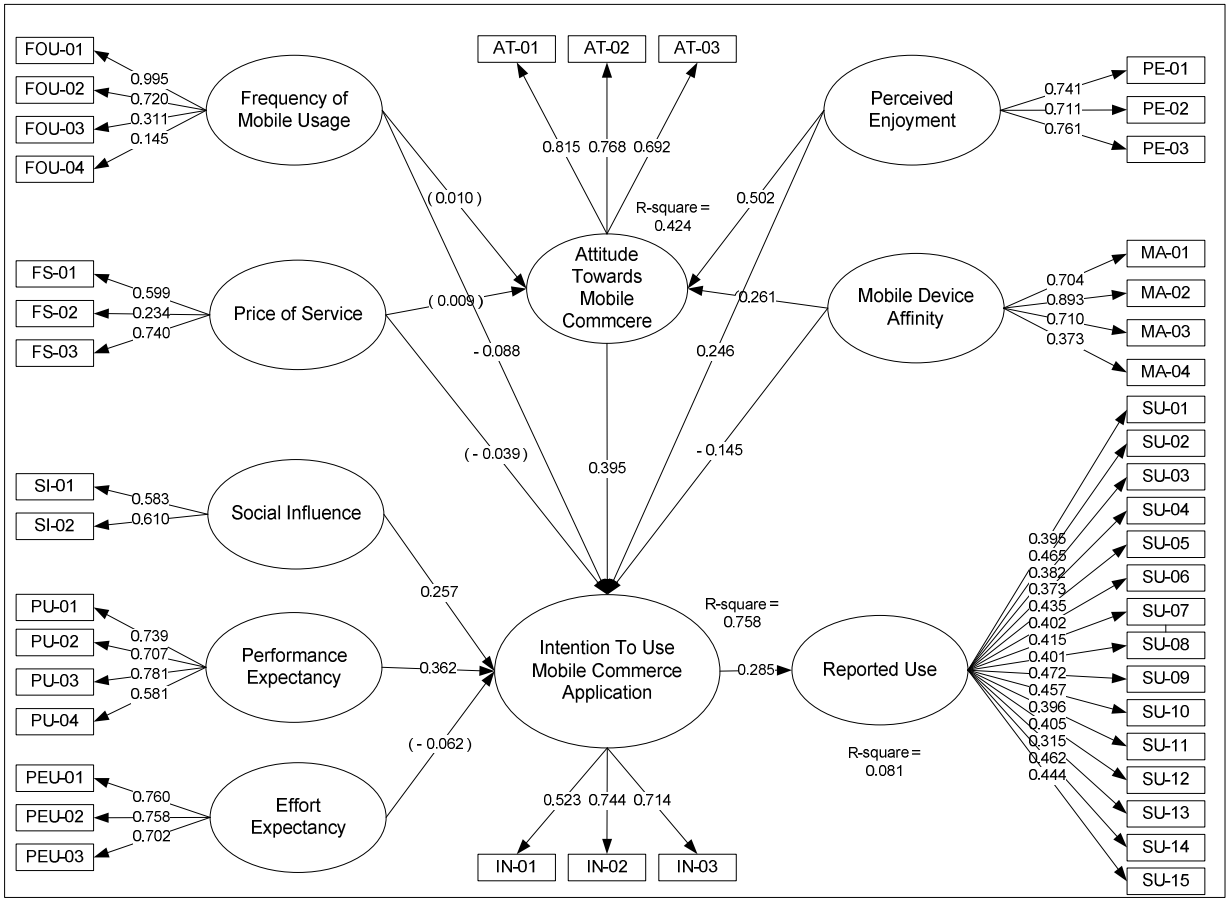
When the data is presented as an interval scale, theoretically this allows for using both the ML and the WLSMV estimators in Mplus to estimate both the structural and the measurement models.

At the case in hand, only the ML estimator can be used, as the WLSMV requires a dataset not containing any missing values. In an attempt to use the WLSMV the data need to be presented without the missing values; this can be specified by using the command "Listwise=On" in the Data section of the Mplus input. In the case at hand, only 338 cases do not include any missing data; this was not enough to use the WLS estimator, as it requires at least 464 cases without any missing values.

In the coming pages, the ML estimator will be used to estimate the structural and the measurement models, the data will be used as collected, no alteration to the data will be made; the Frequency of Usage will be presented as an interval scale and will not be re-coded as in the previous two cases.

Below is Figure 26 showing the structural model testing results:

Figure 26 - Initial Model- Structural Relations - Scale Data - ML



The model seems to provide neither superior nor bad fit indices measures, below in Table 46 is a presentation of the indices:

Table 46 - Initial Model Testing - Fit Indices for Structural Model - Scale Data - ML

Fit index	Recommended Value	Value	Comment
CFI (Comparative Fit Index)	≥0.90	0.875	Below accepted range
TLI (Tucker-Lewis Index)	≥0.90	0.864	Below accepted range
RMSEA	≤0.08	0.041	Within accepted range
SRMR	≤0.08	0.056	Within accepted range

As for the hypothesized relations; not all of them were confirmed; in total, there are five hypothesized relations supported out of thirteen.

Table 47 - Initial Model Testing - Structural Model Relations - Scale Data - Ml

	Hypotheses	**Path Coefficient**	**Critical ratio**	**Two Tailed P-Value**	**Supported/Rejected**
1	Performance Expectancy On the Intention to Use - "**+**"	0.362	4.165	0	Supported
2	Effort Expectancy on the Intention to Use - "**-**"	**-0.062**	**-0.727**	**0.467**	**Rejected**
3	Social Influence on the Intention to Use - "**+**"	**0.257**	**2.036**	**0.042**	**Rejected**
4	Perceived Price of Service on the Intention to Use - "**-** "	**-0.039**	**-0.554**	**0.579**	**Rejected**
5	Frequency of Use on the Intention to Use - "**+**"	**-0.088**	**-1.974**	**0.048**	**Rejected**
6	The Perceived Enjoyment on the Intention to Use - "**+**"	**0.246**	**2.422**	**0.015**	**Rejected**
7	The Mobile Affinity on the Intention to Use - "**+**"	**-0.145**	**-2.628**	**0.009**	**Rejected**
8	Attitude on Intention to Use - "**+**"	0.395	6.172	0	Supported
9	Perceived Price of Service on the Attitude - "**-**"	**0.009**	**0.123**	**0.902**	**Rejected**
10	Frequency of Use on the Attitude - "**+**"	**0.01**	**0.211**	**0.833**	**Rejected**
11	The Perceived Enjoyment on the Attitude - "**+**"	0.502	8.287	0	Supported
12	The Mobile Affinity on the Attitude - "**+**"	0.261	5.104	0	Supported
13	The Intention to Use on the Reported Use - " **+ "**	0.285	5.235	0	Supported

10.3.3.1 TEST OF THE MEASUREMENT MODEL

When testing the measurement model, the scale (interval) representation of the data handled with the ML estimator reported modest fit indices. Half of them were within the accepted range; below they are presented in Table 48 .

Table 48 - Initial Model Testing - Fit Indices For Measurement Model - Scale Data - ML

Fit index	Recommended Value	Value	Comment
CFI (Comparative Fit Index)	≥0.90	0.883	Below accepted range
TLI (Tucker-Lewis Index)	≥0.90	0.871	Below accepted range
RMSEA	≤0.08	0.040	Within accepted range
SRMR	≤0.08	0.054	Within accepted range

The test of the scale properties in terms of reliability, convergent validity and discriminant validity resulted in an acceptable result. Below is Table 49 showing the reliability and convergent validity parameters, unaccepted values are presented in bold font:

Table 49 - Initial Model Testing - Reliabilities- Scale Data - ML

Construct	Item	Mean	Std.dev.	Factor	CR	AVE
USE	SU01	0.12	0.33	**0.39**	0.76	**0.17**
	SU02	0.09	0.28	**0.47**		
	SU03	0.32	0.47	**0.38**		
	SU04	0.12	0.32	**0.38**		
	SU05	0.16	0.37	**0.43**		
	SU06	0.13	0.33	**0.40**		
	SU07	0.30	0.46	**0.42**		
	SU08	0.25	0.43	**0.40**		
	SU09	0.16	0.37	**0.47**		
	SU10	0.08	0.26	**0.46**		
	SU11	0.13	0.34	**0.40**		
	SU12	0.25	0.43	**0.40**		
	SU13	0.11	0.31	**0.31**		

Table 49 - Cnt'd

Construct	Item	Mean	Std.dev.	Factor	CR	AVE
	SU14	0.21	0.41	**0.46**		
	SU15	0.12	0.32	**0.44**		
PE	PU01	1.99	1.30	0.74	0.80	0.50
	PU02	2.23	1.30	0.71		
	PU03	2.06	1.30	0.78		
	PU04	2.74	1.37	**0.58**		
EE	PEU01	2.16	1.35	0.76	0.78	0.55
	PEU02	2.29	1.29	0.76		
	PEU03	2.51	1.33	0.70		
SI	Si01	3.60	1.66	0.63	**0.53**	**0.36**
	Si02	3.12	1.63	0.56		
FS	FS01	3.30	1.56	0.60	**0.55**	**0.32**
	FS02	4.36	1.50	0.23		
	FS03	3.21	1.46	0.75		
FOU	FOU01	9.55	45.39	1.02	0.66	**0.41**
	FOU02	14.20	88.62	0.70		
	FOU03	164.14	653.65	**0.30**		
	FOU04	6.95	39.52	**0.14**		
ENJ	PE01	2.86	1.45	0.74	0.79	0.55
	PE02	3.30	1.74	0.72		
	PE03	3.00	1.53	0.77		
MA	MA01	2.77	1.63	0.70	0.78	**0.48**
	MA02	2.67	1.69	0.89		
	MA03	2.40	1.55	0.71		
	MA04R	3.18	1.80	**0.37**		
IN	IN01	3.38	1.55	**0.50**	0.71	**0.46**
	IN02	2.67	1.43	0.76		
	IN03	2.49	1.40	0.74		
ATT	AT01	2.59	1.56	0.81	0.80	0.58
	AT02	2.44	1.53	0.77		
	AT03	3.09	1.65	0.70		

Almost half of the Items failed to reach the minimum variance extracted of 0.50 to present adequate reliability, only PE, EE, ENJ and ATT managed to report acceptable parameters. On the other hand, the convergent validity through the factor loading appeared to report an acceptable level except for PU04, SI02, FS01, FOU03, FOU04, MA04 and all the USE parameters, which failed to reach the minimum factor loading of 0.6. If the USE parameters (which are binary in nature) were treated as categorical, they would have provided better factor loadings.

The composite reliability reported good values, as only the SI and FS reported values below the accepted 0.6 level.

The discriminant validity test resulted in good outcomes; the measurements performed well except for the usual suspect SI and PE as seen in Table 50.

Table 50 - Initial Model Testing - Discriminant Validity - Scale Data - Ml

Construct	USE	PE	EE	SI	FS	FOU	ENJ	MA	IN	ATT
USE	**0.17**									
PE	0.02	**0.50**								
EE	0.00	0.55	0.55							
SI	0.06	0.15	0.12	**0.36**						
FS	0.06	0.08	0.07	0.29	0.32					
FOU	0.05	0.01	0.00	0.02	0.07	0.41				
ENJ	0.09	0.18	0.18	0.47	0.19	0.00	0.55			
MA	0.00	0.20	0.15	0.14	0.07	0.00	0.14	0.48		
IN	0.06	0.37	0.26	0.43	0.13	0.01	0.47	0.12	**0.46**	
ATT	0.03	0.16	0.20	0.38	0.08	0.00	0.33	0.20	0.50	0.58

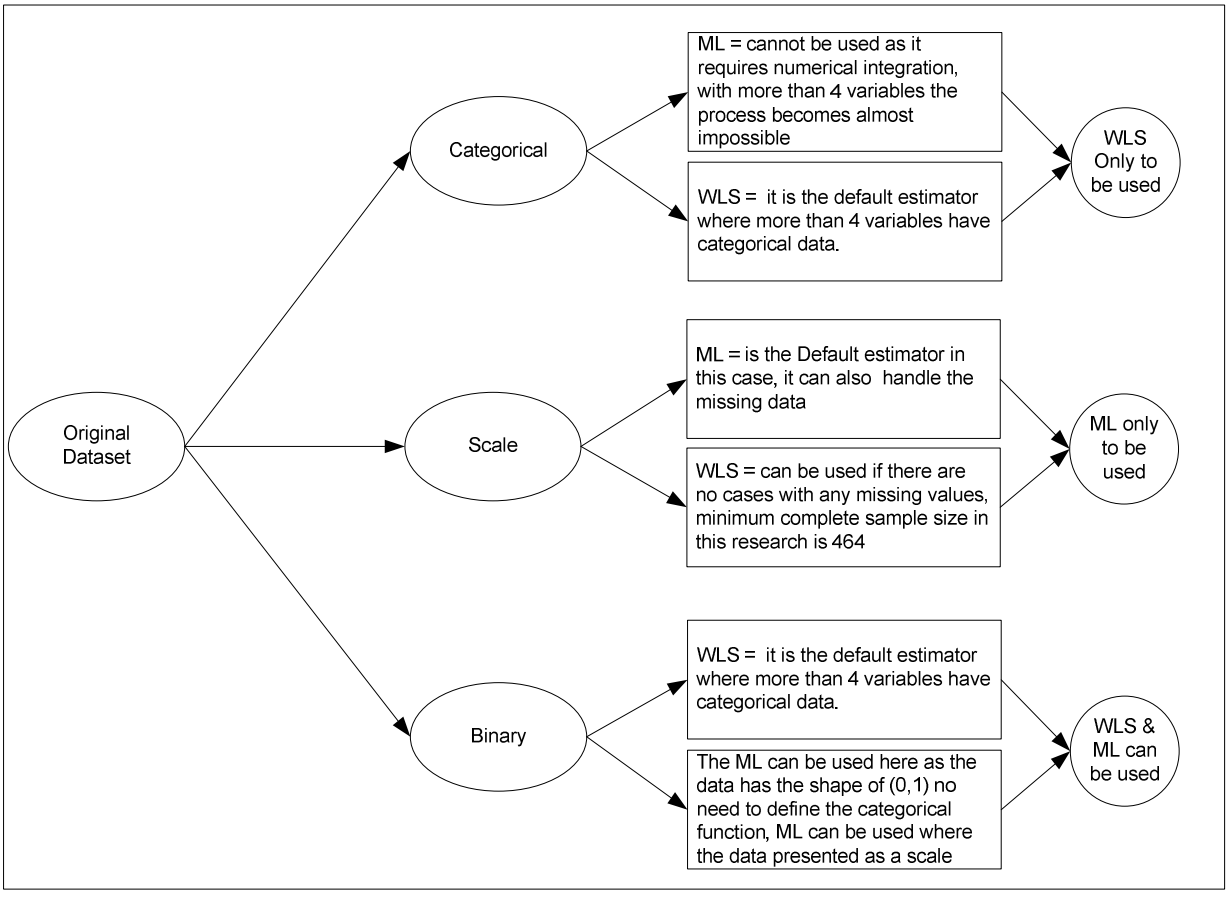
The scale representation of the data showed that the collection tool is quite good, but still need to be revaluated especially the PE, SI and IN constructs.

10.3.4 CONCLUSIONS OF THE ORIGINAL MODEL TESTING

As seen from the previous approaches to presenting the data and handling it with different estimators within Mplus different outcomes resulted from processing the first dataset.

Because the data contained cases with missing values and the relatively large numbers of latent variables, it was not possible to run both estimators the Maximum Likelihood and the Weighted Least Squares on the same sample presentation. Below is Figure 27 showing the data presentations and possible treatments of estimators within the Mplus program.

Figure 27 - Data Presentation And Estimator Choice In Mplus



Source: Own Presentation , (Muthén 2010)

Since it was not possible to run different estimators on one presentation of the first dataset due to the missing values or to the numerical integration requirement, a detailed comparison is not possible among the estimation approached presented earlier. Still some joint comparison can be done on the hypotheses confirmation level (structural level) and on the measurement level. This will be discussed in the following pages.

10.3.4.1 COMPARISON OF THE HYPOTHESES RESULTS

On the structural level, the original hypotheses were tested using variants of data presentations and estimators, some relations held throughout all of these tests where others failed to hold. In this section, a comparison of the hypotheses test results across all tests will be undertaken and interpretation of the relations will be carried out according to how many tests this specific relation managed to pass. Below is Table 51 containing the Model fit indices on the structural level; as it can be noticed only the Binary and the categorical representation of the data coupled with the WLSMV estimator brought satisfactory results at all levels, but the results of Binary presentation with WLSMV estimator will be ignored as it resulted in a non-positive-definite covariance matrix; so interpreting its results might be misleading. The rest of the models resulted in satisfactory results on at least half of the indices. This is adequate for carrying on and interpreting the relations resulting from further testing these models.

Table 51 - Initial Model Testing - Structural Relations - Comparison of Fit Indices

Fit index	Recommended Value	Categorical & WLSMV	Binary & WLSMV	Binary & ML	Scale & ML
CFI (Comparative Fit Index)	≥0.90	0.916	0.906	0.858	0.875
TLI (Tucker-Lewis Index)	≥0.90	0.940	0.922	0.845	0.864
RMSEA	≤0.08	0.060	0.044	0.036	0.041
WRMR	Close to 1	1.299	1.178		
SRMR	≤0.08			0.057	0.056

The comparison of the hypothesized relations will be done through Table 52 containing the hypotheses and the critical ratios for each test. The test regarding the combination "Binary & WLSMV" will be presented in Table 52 but not taken into consideration when interpreting the results; this table can be found below:

Table 52 - Initial Model Testing - Structural Model Relations - Comparison

No.	Hypotheses	expected influence	Critical ratio				Times test is passed
			Categorical & WLSMV	*Binary & WLSMV*	Binary & ML	Scale & ML	
1	Performance Expectancy On the Intention to Use	Positive	2.316	*0.762*	3.653	4.165	3
2	Effort Expectancy on the Intention to Use	Negative	0.572	*-0.524*	-2.377	-0.727	1
3	Social Influence on the Intention to Use	Positive	2.877	*-0.062*	0.816	2.036	2
4	Perceived Price of Service on the Intention to Use	Negative	-2.301	*0.297*	1.122	-0.554	1
5	Frequency of Use on the Intention to Use	Positive	3.718	*0.105*	0.063	-1.974	1
6	The Perceived Enjoyment on the Intention to Use	Positive	0.245	*0.276*	0.584	2.422	1
7	The Mobile Affinity on the Intention to Use	Positive	-3.232	*-0.966*	-1.698	-2.628	0
8	Attitude on Intention to Use	Positive	6.277	*1.971*	3.441	6.172	3
9	Perceived Price of Service on the Attitude	Negative	4.09	*3.177*	1.180	0.123	2
10	Frequency of Use on the Attitude	Positive	-2.465	*1.369*	0.713	0.211	0
11	The Perceived Enjoyment on the Attitude	Positive	7.921	*4.781*	6.007	8.287	3
12	The Mobile Affinity on the Attitude	Positive	4.105	*1.913*	3.578	5.104	3
13	The Intention to Use on the Reported Use	Positive	6.521	*5.731*	5.288	5.235	3

As seen in the table above, not all the hypothesized relations resulted in a satisfactory results across all tests, but still five relations managed to pass all the tests, one relation passed two tests, another five passed one test only and two relations did not pass any test.

The strongest impact on the Intention to Use is found to be the Attitude, the relation is found to be positive as hypothesized and passed all the tests; this relation was also confirmed in earlier research in both the information systems and the Mobile Commerce

realms (Davis, Bagozzi et al. 1989; Carlsson, Walden et al. 2006; Tzong-Ru, Shiou-Yu et al. 2009). The second strongest factor, which also passed all the tests, is found to be the Performance Expectancy; this was found to report a positive relation as hypothesized and in line with previous literature (Davis, Bagozzi et al. 1989; Pedersen 2005; Carlsson, Carlsson et al. 2006). The third strongest relation to influence the Intention to Use is found to be the Social Influence; it managed to pass two tests, this is also in line with earlier research in the Mobile Commerce adoption realm. The Effort Expectancy, Perceived Price of Service and the Perceived Enjoyment have somehow an influence on the Intention to Use. As these relations passed one test only, it makes it hard to interpret the results though some previous literature and studies support these relations. At the case at hand, there are unstable relations and interpreting them may lead to confusion. The Frequency of Use reported a significant positive influence on the Intention and on another test reported a negative significant influence. This construct seems to be highly sensitive to rescaling. Interpreting this relation should be undertaken with caution. The Mobile Affinity reported a significant negative influence on the Intention, which is contradicting the positive hypothesized relation; still it cannot be considered as a strong influence as it managed to pass only one test.

The strongest indicator on the Attitude and in the whole model is found to be the Perceived Enjoyment; this relation is found to be positive as hypothesized and passed all the tests. This also comes in line with the previous research of (van der Heijden 2004). The second strongest determinant of Attitude is found to be the Mobile Affinity, this relation also passed all the tests exhibits a positive sign as hypothesized; this is also found in line with earlier research specially with (Ball-Rokeach 1985; Bauer, Reichardt et al. 2007). The other two hypothesized relations affecting the Attitude the Perceived Price of Service and the Frequency of Use were found to report a significant critical ratio in one test, but have an opposite influence to that hypothesized. These relations are to be considered within the development of the alternative models in later stages.

The relation between the Intention to Use and the Reported Use were found to be significant and influential across all tests, this is in line with the research of (Venkatesh, Morris et al. 2003; Carlsson, Carlsson et al. 2006).

10.3.4.2 COMPARISON OF THE MEASUREMENT MODELS RESULTS

The different tests combined with different data presentations reported relatively diverse results in terms of reliability and validity. In this subchapter, a comparison of the various tests will be presented.

The model fit indices reported relatively close results across different tests; with a range of 6.4% for the CFI scale, 9.7 % for the TLI, 1.8 % for the RMSEA, 0.11 points for the WRMR and a 0.3% on the SRMR. These relatively low ranges shows that there is no much difference on the model fit indices level In this case the test of the "Binary & WLSMV" combination reports normal model estimation and interpretable results and it will be used for comparing the measurement model here unlike the results obtained on the structural level as demonstrated in previous subchapters.

Table 53 - Initial Model Testing - Measurement Model - Comparison Of Fit Indices

Fit index	**Recommended Value**	**Categorical & WLSMV**	**Binary & WLSMV**	**Binary & ML**	**Scale & ML**
CFI (Comparative Fit Index)	≥0.90	0.933	0.929	0.869	0.883
TLI (Tucker-Lewis Index)	≥0.90	0.953	0.943	0.856	0.871
RMSEA	≤0.08	0.053	0.038	0.035	0.040
WRMR	Close to 1	1.181	1.075		
SRMR	≤0.08			0.051	0.054

The reliability will be measured through average variance extracted per construct and through the composite reliability per item. Whereas validity will be measured through convergent validity that is evaluated through the factor loading per Item, all of these are presented in Table 54 below:

Table 54 - Measurement Model Comparison

		Categorical & WLSMV			Binary & WLSMV			*Binary & ML*			Scale & ML		
Construct	Item	Factor	CR	AVE	Factor	CR	AVE	*Factor*	*CR*	*AVE*	Factor	CR	AVE
USE	SU01	**0.58**	0.89	**0.35**	**0.59**	0.89	**0.35**	**0.39**	0.76	**0.17**	**0.39**	0.76	**0.17**
	SU02	0.69			0.68			**0.47**			**0.47**		
	SU03	**0.55**			**0.51**			**0.36**			**0.38**		
	SU04	**0.54**			**0.55**			**0.39**			**0.38**		
	SU05	0.64			0.63			**0.44**			**0.43**		
	SU06	**0.55**			**0.56**			**0.40**			**0.40**		
	SU07	0.67			0.64			**0.42**			**0.42**		
	SU08	**0.54**			**0.54**			**0.40**			**0.40**		
	SU09	0.66			0.66			**0.47**			**0.47**		
	SU10	0.66			0.69			**0.46**			**0.46**		
	SU11	**0.52**			**0.51**			**0.38**			**0.40**		
	SU12	**0.51**			**0.50**			**0.39**			**0.40**		
	SU13	**0.47**			**0.47**			**0.31**			**0.31**		
	SU14	**0.59**			0.61			**0.46**			**0.46**		
	SU15	0.65			0.68			**0.46**			**0.44**		
PE	PU01	0.80	0.84	0.57	0.82	0.88	0.64	0.66	0.71	**0.39**	0.74	0.80	0.50
	PU02	0.73			0.75			**0.59**			0.71		
	PU03	0.81			0.86			0.71			0.78		
	PU04	0.67			0.77			**0.52**			**0.58**		
EE	PEU01	0.81	0.82	0.61	0.88	0.88	0.71	0.73	0.70	**0.44**	0.76	0.78	0.55
	PEU02	0.76			0.87			0.69			0.76		
	PEU03	0.77			0.78			**0.57**			0.70		
SI	Si01	0.64	**0.56**	**0.39**	0.63	**0.51**	**0.34**	**0.52**	**0.36**	**0.22**	0.63	**0.53**	**0.36**
	Si02	0.61			**0.54**			**0.41**			0.56		
FS	FS01	**0.57**	**0.59**	**0.33**	**0.59**	**0.22**	**0.39**	**0.55**	**0.26**	**0.26**	0.60	**0.55**	**0.32**
	FS02	**0.45**			**0.57**			**-0.29**			0.23		
	FS03	0.67			0.70			0.62			0.75		

Table 54 - Cnt'd

Construct	Item	Categorical & WLSMV			Binary & WLSMV			*Binary & ML*			Scale & ML		
		Factor	CR	AVE	Factor	CR	AVE	*Factor*	*CR*	*AVE*	Factor	CR	AVE
FOU	FOU01	0.97	0.84	0.58	0.95	0.83	0.56	0.82	0.70	**0.40**	1.02	0.66	**0.41**
	FOU02	0.85			0.87			0.76			0.70		
	FOU03	0.67			**0.59**			**0.49**			**0.30**		
	FOU04	**0.46**			**0.49**			**0.31**			**0.14**		
ENJ	PE01	0.84	0.82	0.61	0.80	0.81	0.58	0.60	0.64	**0.38**	0.74	0.79	0.55
	PE02	0.72			0.65			**0.54**			0.72		
	PE03	0.77			0.83			0.70			0.77		
MA	MA01	0.78	0.82	0.55	0.79	0.80	0.53	0.61	0.66	**0.36**	0.70	0.78	**0.48**
	MA02	0.90			0.90			0.77			0.89		
	MA03	0.78			0.80			0.63			0.71		
	MA04R	**0.41**			**0.22**			**0.22**			**0.37**		
IN	IN01	0.62	0.76	0.52	0.67	0.75	0.50	**0.49**	**0.56**	**0.30**	**0.50**	0.71	**0.46**
	IN02	0.75			0.74			0.62			0.76		
	IN03	0.77			0.70			**0.53**			0.74		
ATT	AT01	0.83	0.84	0.64	0.82	0.85	0.66	0.69	0.69	**0.43**	0.81	0.80	0.58
	AT02	0.81			0.86			0.68			0.77		
	AT03	0.76			0.76			**0.59**			0.70		

In the Table 54 above, the bold results represent values that failed to meet the minimum requirements of 0.6 for factor loading and composite reliability, and 0.5 for average variance extracted.

At first glance, it seems that using the WLSMV estimator with the categorical and the binary representation reports the best levels of reliability and convergent validity. The second best results were reported by using the ML estimator with an interval representation of the data. The use of the ML estimator coupled with the binary representation resulted in bad results, as none of the AVE values did achieve the minimum requirements where 29 out of 44 failed

to report adequate factor loadings; according to this test, the measurement tool is not adequate and needs revision. Since the other three tests reported rather adequate results, the researcher decided to eliminate the third test "Binary & ML" from the analysis of the measurement tool. This can be explained by the fact that much of the scale properties will be lost when reducing them to a binary scale and still treat them as continuous.

Along the three tests qualified for comparison, the SI and the FS reported bad results along all three tests; in the case of the SI, it is obvious that only two items were not enough to explain the latent indicator and it is a major drawback in the collection tool that has to be considered in any future replication of this study. A minimum of three items is recommended for a SEM application. The case of the FS has to do more with the phrasing and operationalization of the constructs; a detailed review is recommended when the study is replicated. Other than that, the tool seems to report good levels of reliability and convergent validity. Still some revaluation of the FOU03, FOU04 and MR04R questions is needed.

The discriminant validity for the four tests is also presented in Table 55. For better presentation each column represents the diagonal AVE where each parameter is compared to the horizontal and vertical correlation values; AVE diagonal values that are lower than one of the horizontal or the vertical squared correlation values are presented in bold.

Table 55 - Initial Model Testing - Discriminant Validity - Comparison

	Categorical & WLSMV	***Binary & WLSMV***	***Binary & ML***	**Scale & ML**
Construct				
USE	0.35	***0.35***	***0.17***	**0.17**
PE	0.57	***0.64***	***0.39***	**0.50**
EE	0.61	***0.71***	***0.44***	0.55
SI	**0.39**	***0.34***	***0.22***	**0.36**
FS	0.33	***0.39***	***0.26***	0.32
FOU	0.58	*0.56*	*0.40*	0.41
ENJ	0.61	***0.58***	***0.38***	0.55
MA	0.55	*0.53*	*0.36*	0.48
IN	**0.52**	***0.50***	***0.30***	**0.46**
ATT	0.64	***0.66***	***0.43***	0.58

As in the case of reliability and convergent validity, the binary presentation of the data coupled with the ML and the WLSMV estimators reported bad discriminant validity; where in the case of WLSMV eight out of ten did not perform well and in the case of ML and for six out of nine in the case of the WLSMV. It is becoming clear that the recoding of the data into binary reduced the validity and the reliability of the measurement tool.

For the purpose of interpretation, the binary data presentation will be excluded. The usual suspect SI has failed to report good discriminant validity parameters, also the IN and the PE failed to pass any test. The rest of the latent indicators have passed both tests.

10.3.4.3 CONCLUSIONS

After studying the different combinations of data presentations and estimators, the researcher came to these conclusions that will be taken into consideration whilst developing the upcoming exploratory model and while testing it in the confirmatory phase.

- It appears that the binary presentation of the data though recommended in some cases is not suitable for the case at hand. One of the possible reasons is the wide range (6 points likert scale) of answer possibilities in the original collections tool.
- The rescaling into binary appears to reduce the interpretation capabilities of the scale used, in the case at hand excessive information is lost.
- The structural model fit indices did not vary a lot throughout different presentations of data using different estimators.
- The WLSMV appears to report better results. This is in line with some research indicating that the WLSMV appears to show better performance when using nonormal data or highly peaked data(Ulf Henning Olsson 2000), which is the case at hand.
- For the exploratory and confirmatory phases, only two variants will be used and compared, the first one is the categorical representation of the data along with the default estimator for such a case which is WLSMV. The second one is the interval presentation of the data with the default estimator for such a case that is the ML.

10.4 THE EXPLORATORY PHASE

As the initial model proposed did not perform well on some of the hypothesized relations, this left place for an exploratory phase to be undertaken where an exploratory model will be compiled using the first dataset.

From observing the data behavior along the various sections of the first part of this chapter, it was obvious that there is a weakness in the collection tool specifically with the constructs Social Influence and the Price of Service; these will be taken into consideration while developing the exploratory model.

In addition, some reliability and validity issues appeared in some of the variables like MA04R and the FOU04; these shall be excluded from the development of the exploratory model.

For the development of the exploratory model, a trial and error strategy based on the previous literature and the findings from the first part of this chapter is undertaken. The researcher decided to eliminate the Frequency of Usage construct from the development of the exploratory model due to the fact that it is more related to the usage of the very classical mobile services i.e. voice and SMS and does not really participate in predicting any of the uptake of coming mobile services. Also the Price of Service will be eliminated from developing the exploratory model; this construct reported bad reliability and validity parameters during the initial model measurement. It is recommended to include this construct in future replications of this study after comprehensively reviewing the construct's indicators.

The core constructs in this research stem from the UTAUT, these are the ones that will be used in developing the exploratory model along with some others; these constructs include:

- Effort Expectancy
- Performance Expectancy
- Social Influence
- Intention to Use
- Perceived Enjoyment
- Mobile Device Affinity

- Attitude Towards Mobile Commerce
- Reported Usage

10.4.1 THE EXPLORATORY STRUCTURAL MODEL - WLSMV:

For the sake of the development of the exploratory model, the first dataset will be presented in categorical form and the estimator WLSMV will be used. The ML estimator assuming interval data will be used as a secondary testing tool; though the results from the ML will not be adopted for the development of the model, still more light can be shed on the model through the secondary testing.

The Reported Use is measured through 15 mobile services, the respondents had to indicate if they use them or not. A value of one represents using it, and a value of zero represents not using it. This scale is an inverse to what is used along that whole collection tool, so in order to avoid confusion, these scales have been reversed. The term "SU" will be used for the observed variables of the Reported Use, which will be referred to as "USE".

The structural model has been estimated and reported good fit indices as indicated in Table 56 bellow:

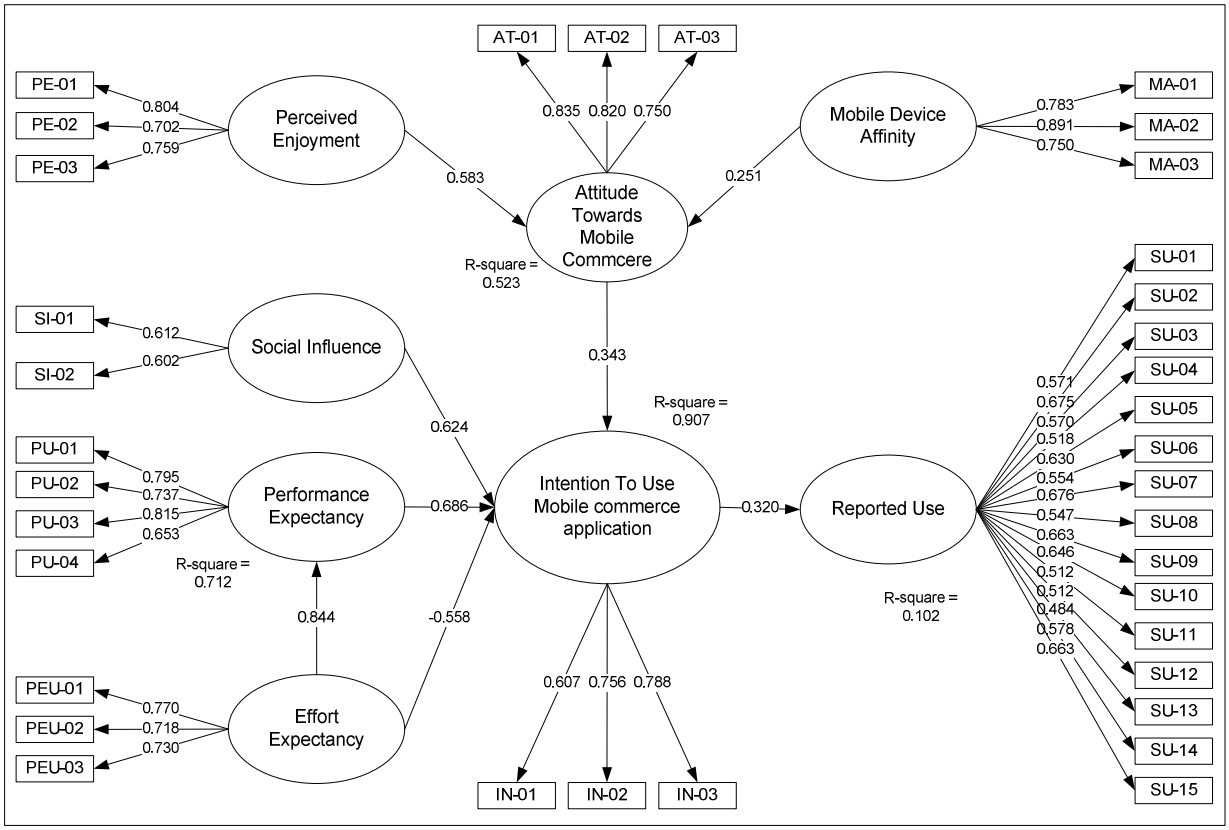
Table 56 - Exploratory Structural Model - Fit Indices - WLSMV

Fit index	Recommended Value	Value	Comment
CFI (Comparative Fit Index)	≥0.90	0.945	Within accepted range
TLI (Tucker-Lewis Index)	≥0.90	0.962	Within accepted range
RMSEA	≤0.08	0.053	Within accepted range
WRMR	Close to 1	1.188	Within accepted range

All of the new relations in the exploratory model stem from the initial relations suggested in the original model and the UTAUT, still a new but classical relation is found between the Effort Expectancy and the Performance Expectancy.

Below is Figure 28 showing the new relations and the factor loadings:

Figure 28 - Exploratory Model - WLSMV



All factor loadings are significant at a p-value of less than 1%. Below is Table 57 where it specifies the relation, its nature, the path coefficient, the critical ratio and the two-tailed p-value of each of the relations in the exploratory model.

Table 57 - Exploratory Model Relations

No	Relation	Path Coefficient	Critical ratio	Two Tailed P-Value
1	Effort Expectancy on Performance Expectancy - "**+**"	0.844	33.375	0
2	Performance Expectancy On the Intention to Use - "**+**"	0.686	4.436	0
3	Effort Expectancy on the Intention to Use - "**-**"	-0.558	-3.157	0.002
4	Social Influence on the Intention to Use - "**+**"	0.624	8.444	0
5	Attitude on Intention to Use - "**+**"	0.343	5.66	0
6	The Perceived Enjoyment on the Attitude - "**+**"	0.583	14.072	0
7	The Mobile Affinity on the Attitude - "**+**"	0.251	5.172	0
8	The Intention to Use on the Reported Use - "**+**"	0.32	5.413	0

10.4.1.1 THE EXPLORATORY MEASUREMENT MODEL-WLSMV:

As has been done in earlier sections, the measurement model will be evaluated while ignoring the structural part. The total number of the measurement items in the exploratory model is 36.

The model fit indices reported acceptable values within the recommended range. Below is Table 58 presenting the reported fit indices:

Table 58 - Model Fit Indices -Exploratory Measurement Model - WLSMV

Fit index	Recommended Value	Value
CFI (Comparative Fit Index)	≥0.90	0.953
TLI (Tucker-Lewis Index)	≥0.90	0.968
RMSEA	≤0.08	0.049
WRMR	Close to 1	1.097

The reliability, composite reliability and the average variance extracted is calculated and presented in a table form, below are the results for the measurement model:

Table 59 - Reliability - Exploratory Model - WLSMV

Construct	Item	Mean	Std.dev.	Factor	CR	AVE
USE	SU01	0.12	0.33	**0.569**	0.89	**0.35**
	SU02	0.09	0.28	0.686		
	SU03	0.32	0.47	**0.561**		
	SU04	0.12	0.32	**0.527**		
	SU05	0.16	0.37	0.623		
	SU06	0.13	0.33	**0.551**		
	SU07	0.30	0.46	0.673		
	SU08	0.25	0.43	**0.548**		
	SU09	0.16	0.37	0.662		
	SU10	0.08	0.26	0.649		
	SU11	0.13	0.34	**0.516**		
	SU12	0.25	0.43	**0.510**		
	SU13	0.11	0.31	**0.490**		
	SU14	0.21	0.41	**0.579**		
	SU15	0.12	0.32	0.664		
PE	PU01	1.99	1.28	0.797	0.84	0.57
	PU02	2.23	1.26	0.736		
	PU03	2.06	1.33	0.814		
	PU04	2.74	1.39	0.654		
EE	PEU01	2.16	1.28	0.812	0.82	0.61
	PEU02	2.29	1.31	0.755		
	PEU03	2.51	1.31	0.767		
SI	Si01	3.60	1.62	0.631	**0.56**	**0.39**
	Si02	3.11	1.48	0.615		
ENJ	PE01	2.87	1.35	0.832	0.82	0.61
	PE02	3.29	1.63	0.723		
	PE03	3.00	1.40	0.780		
MA	MA01	2.78	1.66	0.784	0.85	0.66
	MA02	2.68	1.63	0.894		

Table 59 Cnt'd

	MA03	2.40	1.53	0.755		
IN	IN01	3.39	1.49	0.604	0.76	0.52
	IN02	2.68	1.34	0.754		
	IN03	2.48	1.32	0.785		
ATT	AT01	2.59	1.51	0.832	0.84	0.64
	AT02	2.44	1.44	0.818		
	AT03	3.07	1.64	0.749		

The measurement tool performed pretty well, all items presented acceptable reliability, nine out of fifteen items used to measure the Reported Use failed to report high factor loadings that affected the average variance extracted. As expected, the Social Influence indicators failed to reach the minimum requirements for the average variance extracted and the composite reliability.

Table 60 below is presenting the AVE on the diagonal and the squares of the inter-variable correlation. This identifies the discriminant validity that was found to be acceptable for all items except for the Intention and the Social Influence, as recommended earlier; these two constructs have to be reevaluated.

Table 60 - Discriminant Validity - Exploratory Model - WLSMV

Construct	USE	PE	EE	SI	ENJ	MA	IN	ATT
USE	0.35							
PE	0.05	0.57						
EE	0.00	0.56	0.61					
SI	0.08	0.23	0.15	**0.39**				
ENJ	0.11	0.22	0.22	0.49	0.61			
MA	0.00	0.27	0.21	0.17	0.18	0.66		
IN	0.11	0.39	0.29	0.63	0.51	0.15	**0.52**	
ATT	0.04	0.19	0.22	0.44	0.36	0.23	0.54	0.64

This model will be tested further using the ML estimator; this is being undertaken in the following subchapter.

10.4.2 THE EXPLORATORY STRUCTURAL MODEL - ML:

As mentioned earlier, The ML estimator coupled with interval data presentation will be used as a secondary testing tool; the structural model has been estimated and reported good fit indices as indicated in Table 61 bellow:

Table 61 - Exploratory Structural Model - Fit Indices - ML

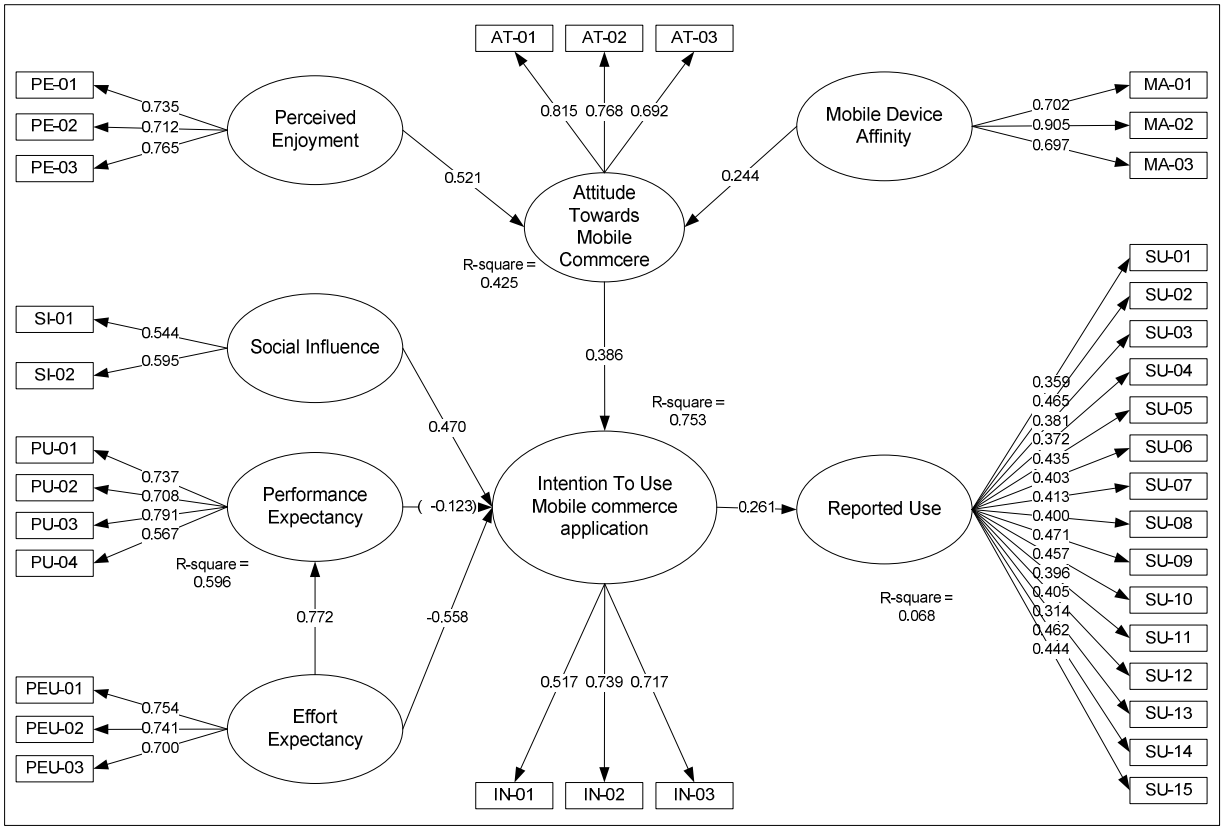
Fit index	Recommended Value	Value	Comment
CFI (Comparative Fit Index)	≥0.90	0.884	Almost on accepted range
TLI (Tucker-Lewis Index)	≥0.90	0.874	Almost accepted range
RMSEA	≤0.08	0.044	within accepted range
SRMR	≤0.08	0.055	within accepted range

The comparative fit indicatives, CFI and the TLI, reported lower compared to the results obtained in the last subchapter above, still the RMSEA and the SRMR reported excellent values binding to the very strict standards of less than 0.06 proposed by (Hu and Bentler 1999).

Only one of the new relations in the primary exploratory model has failed to report significance while using the ML estimator, this relation is the Effort Expectancy on the Intention to Use.

Below is Figure 29 showing the new relations and the factor loadings:

Figure 29 - Exploratory Model - ML



All of the relations except for the “Attitude on Intention to Use“ reported lower loadings and critical ratios and as mentioned earlier, the Effort Expectancy on the Intention to Use was rejected. Below is Table 62 showing a comparison between the use of the WLSMV and the ML estimators.

Table 62 - Exploratory Model Relations - Comparison Between WLSMV And ML

No	Relation	WLSMV		ML	
		Path Coefficient	Critical ratio	Path Coefficient	Critical ratio
1	Effort Expectancy on Performance Expectancy - "+"	0.844	33.375	0.772	24.566
2	Performance Expectancy On the Intention to Use - "+"	0.686	4.436	0.384	4.295
3	Effort Expectancy on the Intention to Use - "-"	-0.558	-3.157	**-0.123**	**-1.23**
4	Social Influence on the Intention to Use - "+"	0.624	8.444	0.47	5.884
5	Attitude on Intention to Use - "+"	0.343	5.66	0.386	6.079
6	The Perceived Enjoyment on the Attitude - "+"	0.583	14.072	0.521	10.754
7	The Mobile Affinity on the Attitude - "+"	0.251	5.172	0.244	4.815
8	The Intention to Use on the Reported Use - "+"	0.32	5.413	0.261	4.819

10.4.2.1 THE EXPLORATORY MEASUREMENT MODEL-ML

The model fit indices reached almost acceptable values for the CFI and TLI and superb Values for the RMSEA and SRMR, below is Table 63 presenting the reported fit indices for the ML and the WLSMV:

Table 63 - Model Fit Indices -Exploratory Measurement Model - ML Vs WLSMV

Fit index	Recommended Value	Value ML	Value WLSMV
CFI (Comparative Fit Index)	≥0.90	0.894	0.953
TLI (Tucker-Lewis Index)	≥0.90	0.882	0.968
RMSEA	≤0.08	0.043	0.049
SRMR	≤0.08	0.051	
WRMR	Close to 1		1.097

As seen in Table 63 above, the WLSMV reported better comparative fit indices where both approaches reported superb RMSEA, SRMS and WRMR.

The reliability, composite reliability and the average variance extracted is calculated and presented in a table form, below is Table 64 showing the results for the measurement model:

Table 64 - Reliability - Exploratory Model - ML

Construct	Item	Mean	Std.dev.	Factor	CR	AVE
USE	SU01	0.12	0.33	**0.394**	0.76	**0.17**
	SU02	0.09	0.28	**0.469**		
	SU03	0.32	0.47	**0.378**		
	SU04	0.12	0.32	**0.377**		
	SU05	0.16	0.37	**0.432**		
	SU06	0.13	0.33	**0.399**		
	SU07	0.30	0.46	**0.416**		
	SU08	0.25	0.43	**0.401**		
	SU09	0.16	0.37	**0.472**		
	SU10	0.08	0.26	**0.456**		
	SU11	0.13	0.34	**0.397**		
	SU12	0.25	0.43	**0.402**		
	SU13	0.11	0.31	**0.318**		
	SU14	0.21	0.41	**0.463**		
	SU15	0.12	0.32	**0.447**		
PE	PU01	1.99	1.28	0.74	0.80	0.50
	PU02	2.23	1.26	0.706		
	PU03	2.06	1.33	0.782		
	PU04	2.74	1.39	**0.579**		
EE	PEU01	2.16	1.28	0.763	0.78	0.55
	PEU02	2.29	1.31	0.759		
	PEU03	2.51	1.31	0.698		
SI	Si01	3.60	1.62	0.613	**0.52**	**0.35**
	Si02	3.11	1.48	0.577		
ENJ	PE01	2.87	1.35	0.736	0.79	0.55
	PE02	3.29	1.63	0.718		

Table 64 Cnt'd

Construct	Item	Mean	Std.dev.	Factor	CR	AVE
	PE03	3.00	1.40	0.777		
MA	MA01	2.78	1.66	0.703	0.82	0.60
	MA02	2.68	1.63	0.906		
	MA03	2.40	1.53	0.696		
IN	IN01	3.39	1.49	0.5	0.71	**0.46**
	IN02	2.68	1.34	0.756		
	IN03	2.48	1.32	0.741		
ATT	AT01	2.59	1.51	0.809	0.80	0.58
	AT02	2.44	1.44	0.768		
	AT03	3.07	1.64	0.698		

Compared to the WLSMV estimates in the last section, similar results were obtained as the Social Influence did not reach the minimum requirements reliability. In addition, the Intention to Use reported almost but still not acceptable AVE. The USE reported low factor loadings on all Items.

Discriminant validity performed well as seen in Table 65 below, the Performance Expectancy, Social Influence and Intention to Use may need revision before replicating this study.

Table 65 - Discriminant Validity - Exploratory Model - ML

Construct	USE	PE	EE	SI	ENJ	MA	IN	ATT
USE	0.17							
PE	0.02	**0.50**						
EE	0.00	0.55	0.55					
SI	0.06	0.15	0.12	**0.35**				
ENJ	0.09	0.18	0.18	0.47	0.55			
MA	0.00	0.19	0.16	0.14	0.14	0.60		
IN	0.06	0.37	0.26	0.44	0.47	0.12	**0.46**	
ATT	0.03	0.16	0.20	0.38	0.33	0.19	0.50	0.58

After several model testing attempts, the model presented in the last two subchapters from the exploratory phase is regarded as the final model. This model will be taken to the next phase where it will be tested again to validate the relationships implied within the coming confirmatory resting phase.

10.5 THE CONFIRMATORY PHASE

After developing the exploratory model in part two , the second dataset will be used to confirm the results of the new hypothesized relations developed in part two. Besides confirming and retesting the relations, the validity and the reliability of the measurements will be tested again.

The second dataset consisted of 589 cases and involved 36 independent variables into the estimation process and eight latent variables. It also consisted of 56 missing data patterns.

In this part, the researcher will test the exploratory model with the second dataset twice, once using the WLSMV estimator and in a second run using the ML estimator replicating the steps undertaken in the second part.

10.5.1 THE CONFIRMATORY STRUCTURAL MODEL - WLSMV

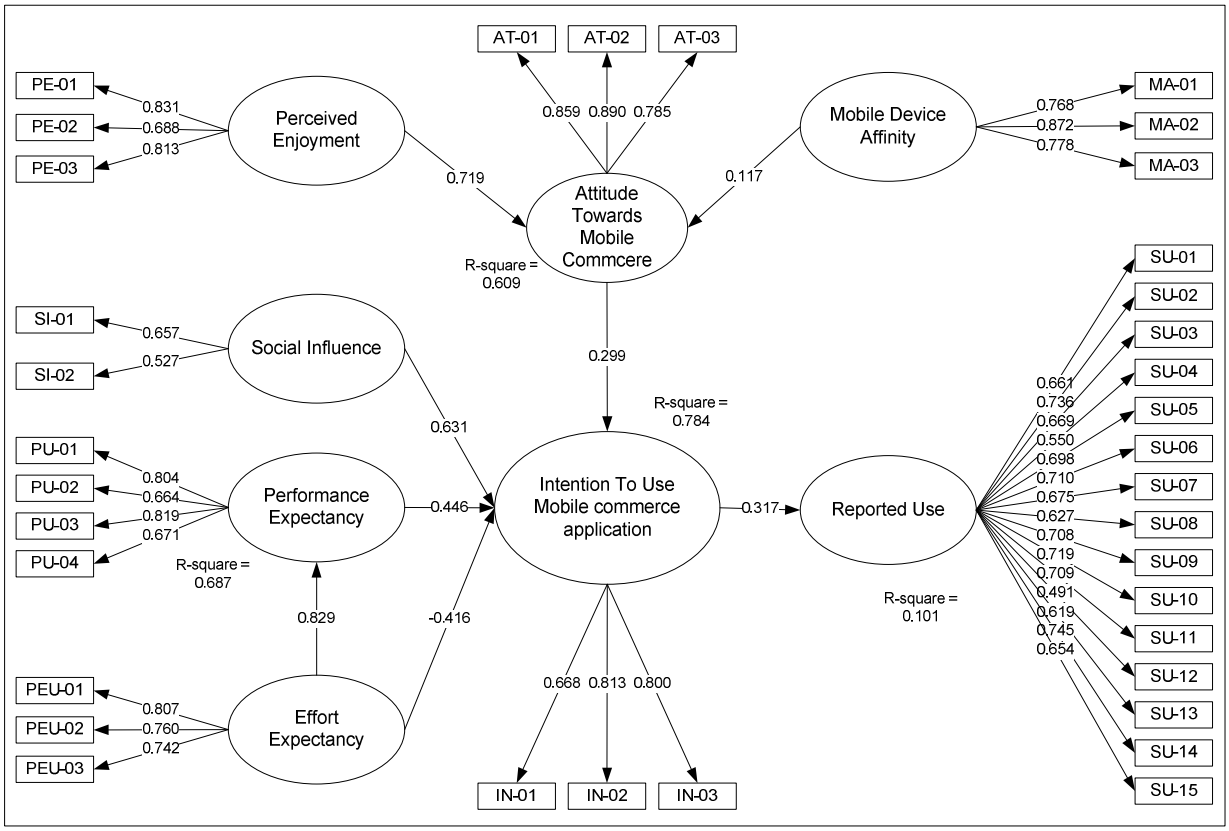
Testing the exploratory model with the hold-out data set resulted in similar results on both the measurement and the structural levels. The fit indices for the structural testing reported similar results, all of the fit indices are found to be within the accepted and recommended ranges to present a good model fit. For comparison purposes, Table 66 below shows the fit indices for both the exploratory and the confirmatory tests:

Table 66 - Structural Model - Confirmatory Vs Exploratory- Fit Indices - WLSMV

Fit index	Recommended Value	Exploratory	Confirmatory
CFI (Comparative Fit Index)	≥0.90	0.945	0.916
TLI (Tucker-Lewis Index)	≥0.90	0.962	0.954
RMSEA	≤0.08	0.053	0.066
WRMR	Close to 1	1.188	1.418

All the structural relations proved to hold in the confirmatory testing phase, below is Figure 30, which illustrates the relations.

Figure 30 - Confirmatory Model - WLSMV



All the relations were found to become weaker but still significant in the confirmatory phase except for two relations that were found to become stronger. These relations are the "Perceived Enjoyment on the Attitude" and the "Intention to Use on the Reported Use". Below is Table 67 showing a comparison between the results of the exploratory testing phase and the confirmatory one.

Table 67 - Exploratory Vs Confirmatory Model Relations - WLSMV

No	Relation	Exploratory			Confirmatory		
		Path Coefficient	Critical ratio	Two Tailed P-Value	Path Coefficient	Critical ratio	Two Tailed P-Value
1	Effort Expectancy on Performance Expectancy - "**+**"	0.844	33.375	0	0.829	29.828	0
2	Performance Expectancy On the Intention to Use - "**+**"	0.686	4.436	0	0.464	3.695	0
3	Effort Expectancy on the Intention to Use - "**-**"	-0.558	-3.157	0.002	-0.416	-2.601	0.009
4	Social Influence on the Intention to Use - "**+**"	0.624	8.444	0	0.631	6.037	0
5	Attitude on Intention to Use - "**+**"	0.343	5.66	0	0.299	4.444	0
6	The Perceived Enjoyment on the Attitude - "**+**"	0.583	14.072	0	0.719	20.632	0
7	The Mobile Affinity on the Attitude - "**+**"	0.251	5.172	0	0.117	2.4	0.016
8	The Intention to Use on the Reported Use - "**+**"	0.32	5.413	0	0.317	5.831	0

The structural relations held through the confirmatory testing phase while using the WLSMV estimator with a p-Value of less than 1% except for the relation between the Mobile Affinity and the Attitude, which is still significant, but with a p-value of 1.6%.

Both the exploratory and the confirmatory models using the WLSMV approximated the data in a good way.

10.5.1.1 THE CONFIRMATORY MEASUREMENT MODEL-WLSMV:

The model fit indices are reported in Table 68 below, all indicators are still within the accepted ranges, but showed a weaker performance comparing to the exploratory model.

Table 68 - Measurement Model Fit Indices - Confirmatory Vs Exploratory - WLSMV

Fit index	Recommended Value	Value- Exploratory Model	Value - Confirmatory Model
CFI (Comparative Fit Index)	≥0.90	0.953	0.935
TLI (Tucker-Lewis Index)	≥0.90	0.968	0.966
RMSEA	≤0.08	0.049	0.058
WRMR	Close to 1	1.097	1.242

The reliability measures showed similar performance to those of the exploratory model. Still the USE variables showed a better performance with the second dataset. On the next page there is Table 69 showing the results of the exploratory and the confirmatory models tests side by side.

Table 69 - Reliability - Exploratory Vs Confirmatory - WLSMV

Construct	Item	Mean	Std.dev.	Exploratory			confirmatory		
				Factor	CR	AVE	Factor	CR	AVE
USE	SU01	0.12	0.33	**0.569**	0.89	0.35	0.663	0.92	**0.45**
	SU02	0.09	0.28	0.686			0.74		
	SU03	0.32	0.47	**0.561**			0.666		
	SU04	0.12	0.32	**0.527**			**0.561**		
	SU05	0.16	0.37	0.623			0.699		
	SU06	0.13	0.33	**0.551**			0.699		
	SU07	0.30	0.46	0.673			0.671		
	SU08	0.25	0.43	**0.548**			0.624		
	SU09	0.16	0.37	0.662			0.705		
	SU10	0.08	0.26	0.649			0.726		
	SU11	0.13	0.34	**0.516**			0.713		
	SU12	0.25	0.43	**0.510**			**0.492**		
	SU13	0.11	0.31	**0.490**			0.624		

Table 69 Cnt'd

Construct	Item	Mean	Std.dev.	Exploratory			confirmatory		
				Factor	CR	AVE	Factor	CR	AVE
	SU14	0.21	0.41	**0.579**			0.744		
	SU15	0.12	0.32	0.664			0.651		
PE	PU01	1.99	1.28	0.797	0.84	0.57	0.806	0.83	0.55
	PU02	2.23	1.26	0.736			0.664		
	PU03	2.06	1.33	0.814			0.819		
	PU04	2.74	1.39	0.654			0.668		
EE	PEU01	2.16	1.28	0.812	0.82	0.61	0.852	0.86	0.67
	PEU02	2.29	1.31	0.755			0.803		
	PEU03	2.51	1.31	0.767			0.791		
SI	Si01	3.60	1.62	0.631	**0.56**	**0.39**	0.625	**0.48**	**0.32**
	Si02	3.11	1.48	0.615			**0.503**		
ENJ	PE01	2.87	1.35	0.832	0.82	0.61	0.873	0.85	0.66
	PE02	3.29	1.63	0.723			0.715		
	PE03	3.00	1.40	0.78			0.845		
MA	MA01	2.78	1.66	0.784	0.85	0.66	0.77	0.85	0.65
	MA02	2.68	1.63	0.894			0.873		
	MA03	2.40	1.53	0.755			0.78		
IN	IN01	3.39	1.49	0.604	0.76	0.52	0.66	0.80	0.57
	IN02	2.68	1.34	0.754			0.806		
	IN03	2.48	1.32	0.785			0.791		
ATT	AT01	2.59	1.51	0.832	0.84	0.64	0.858	0.88	0.71
	AT02	2.44	1.44	0.818			0.889		
	AT03	3.07	1.64	0.749			0.784		

The discriminant validity as presented in Table 70 below shows an acceptable range of measures except for the Social Influence.

Table 70 - Discriminant Validity - Confirmatory - WLSMV

Construct	USE	PE	EE	SI	ENJ	MA	IN	ATT
USE	0.45							
PE	0.02	0.55						
EE	0.00	0.48	0.67					
SI	0.17	0.42	0.23	**0.32**				
ENJ	0.10	0.24	0.19	0.68	0.66			
MA	0.01	0.24	0.13	0.20	0.23	0.65		
IN	0.12	0.34	0.30	0.69	0.52	0.13	0.57	
ATT	0.03	0.20	0.26	0.70	0.46	0.19	0.57	0.71

10.5.2 THE CONFIRMATORY STRUCTURAL MODEL - ML

The fit indices for the structural testing reported results similar to the exploratory phase. As in the exploratory phase, the comparative fit indicatives CFI and the TL reported measures close to the accepted values but did not pass them; the RMSEA and the SRMR reported excellent values.

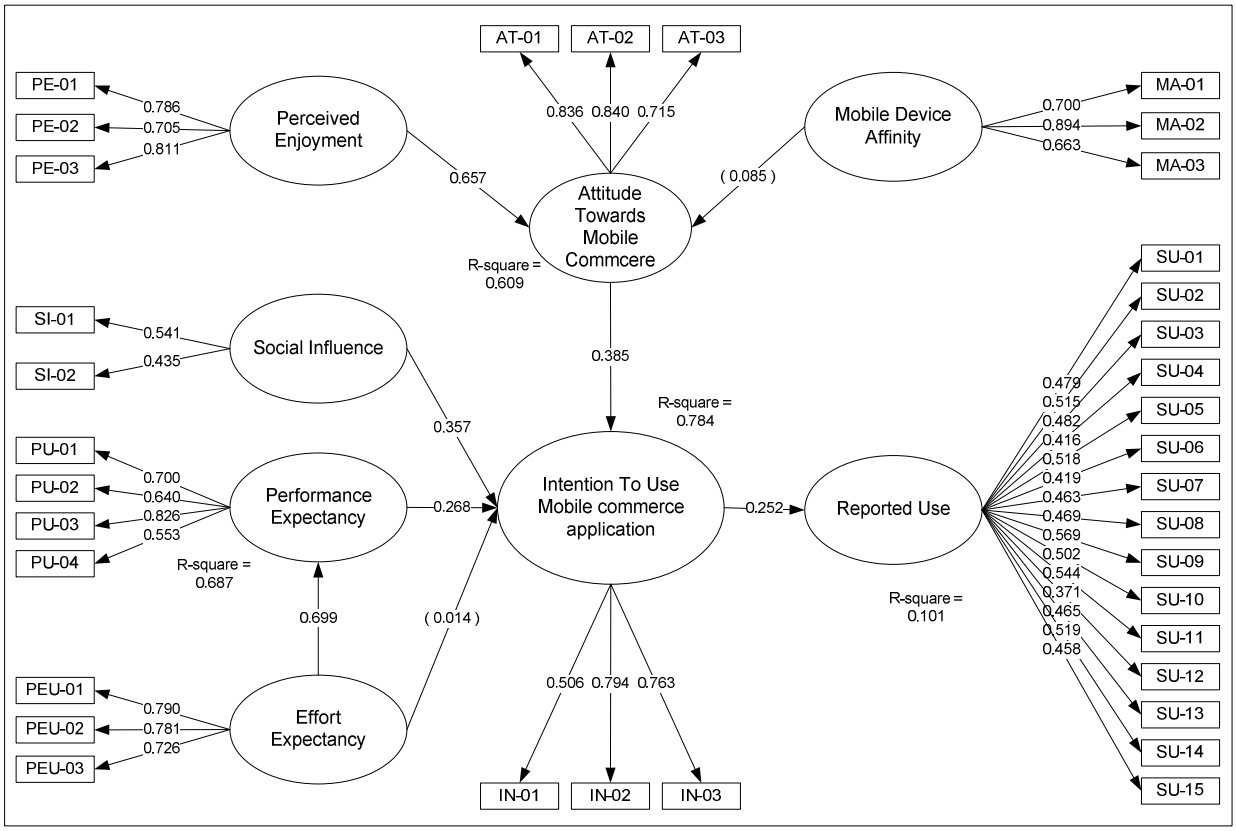
Table 71 - Confirmatory Structural Model - Fit Indices - ML

Fit index	Recommended Value	Exploratory	Confirmatory
CFI (Comparative Fit Index)	≥0.90	0.884	0.876
TLI (Tucker-Lewis Index)	≥0.90	0.874	0.865
RMSEA	≤0.08	0.044	0.050
SRMR	≤0.08	0.055	0.063

In the exploratory model testing using the ML estimator, only one relation failed to report significant measures; this relation is the Effort Expectancy on the Intention to Use, In the confirmatory testing another relation failed to report significant measures; this is the Mobile Affinity on the Attitude; it reported a p-value of 0.069 which is relatively close to the cutoff point of 0.05. Below is

Figure 31 that illustrates the relations.

Figure 31 - Confirmatory Model - ML



A comparison of the relations and their estimates between the exploratory and the confirmatory models is found in Table 72 - Confirmatory Model Relations - Ml on the next page:

Table 72 - Confirmatory Model Relations - Ml

No	Relation	ML - Exploratory		ML - Confirmatory	
		Path Coefficient	Critical ratio	Path Coefficient	Critical ratio
1	Effort Expectancy on Performance Expectancy - "+"	0.772	24.566	0.699	21.483
2	Performance Expectancy On the Intention to Use - "+"	0.384	4.295	0.268	4.115
3	Effort Expectancy on the Intention to Use - "-"	**-0.123**	**-1.23**	**0.014**	**0.186**
4	Social Influence on the Intention to Use - "+"	0.47	5.884	0.357	4.885
5	Attitude on Intention to Use - "+"	0.386	6.079	0.385	6.001
6	The Perceived Enjoyment on the Attitude - "+"	0.521	10.754	0.657	16.45
7	The Mobile Affinity on the Attitude - "+"	0.244	4.815	**0.085**	**1.819**
8	The Intention to Use on the Reported Use - "+"	0.261	4.819	0.252	5.266

All of the relations proved to be consistent with the results of the exploratory model when using the ML estimator. The relation between the Effort Expectancy and the Intention to Use is still insignificant and a new relation proved to be insignificant which is the relation between the Mobile Affinity and the Attitude.

10.5.2.1 THE CONFIRMATORY MEASUREMENT MODEL-ML

The model fit indices reported almost identical value for the CFI and TLI to what resulted from the exploratory phase, also almost identical for the RMSEA and the SRMR. All of the indices are within the acceptable ranges. Below is Table 73 presenting the reported fit indices for the exploratory and the confirmatory models:

Table 73 - Model Fit Indices - Confirmatory Measurement Model - ML

Fit index	Recommended Value	Exploratory	Confirmatory
CFI (Comparative Fit Index)	≥0.90	0.894	0.893
TLI (Tucker-Lewis Index)	≥0.90	0.882	0.881
RMSEA	≤0.08	0.043	0.047
SRMR	≤0.08	0.051	0.054

The reliability, composite reliability and the average variance extracted is calculated and presented in a table form, below in Table 74 are the results for the measurement model:

Table 74 - Reliability - Confirmatory Model - ML

Construct	Item	Mean	Std.dev.	Exploratory			Confirmatory		
				Factor	CR	AVE	Factor	CR	AVE
USE	SU01	0.12	0.33	**0.39**	0.76	0.17	**0.48**	0.82	**0.24**
	SU02	0.09	0.28	**0.47**			**0.515**		
	SU03	0.32	0.47	**0.38**			**0.484**		
	SU04	0.12	0.32	**0.38**			**0.42**		
	SU05	0.16	0.37	**0.43**			**0.519**		
	SU06	0.13	0.33	**0.40**			**0.487**		
	SU07	0.30	0.46	**0.42**			**0.467**		
	SU08	0.25	0.43	**0.40**			**0.466**		
	SU09	0.16	0.37	**0.47**			**0.565**		
	SU10	0.08	0.26	**0.46**			**0.505**		
	SU11	0.13	0.34	**0.40**			**0.545**		
	SU12	0.25	0.43	**0.40**			**0.37**		
	SU13	0.11	0.31	**0.32**			**0.468**		
	SU14	0.21	0.41	**0.46**			**0.522**		
	SU15	0.12	0.32	**0.45**			**0.457**		
PE	PU01	1.99	1.28	0.74	0.80	0.50	0.712	0.78	**0.47**
	PU02	2.23	1.26	0.71			0.643		
	PU03	2.06	1.33	0.78			0.813		

Table 74 Cnt'd

Construct	Item	Mean	Std.dev.	Exploratory			Confirmatory		
				Factor	CR	AVE	Factor	CR	AVE
	PU04	2.74	1.39	0.58			**0.559**		
EE	PEU01	2.16	1.28	0.76	0.78	0.55	0.797	0.82	0.60
	PEU02	2.29	1.31	0.76			0.792		
	PEU03	2.51	1.31	0.70			0.724		
SI	Si01	3.60	1.62	0.61	0.52	0.35	0.657	**0.46**	**0.31**
	Si02	3.11	1.48	**0.58**			**0.436**		
ENJ	PE01	2.87	1.35	0.74	0.79	0.55	0.789	0.82	0.60
	PE02	3.29	1.63	0.72			0.716		
	PE03	3.00	1.40	0.78			0.823		
MA	MA01	2.78	1.66	0.70	0.82	0.60	0.703	0.80	0.58
	MA02	2.68	1.63	0.91			0.89		
	MA03	2.40	1.53	0.70			0.665		
IN	IN01	3.39	1.49	**0.50**	0.71	0.46	0.492	0.74	0.50
	IN02	2.68	1.34	0.76			0.805		
	IN03	2.48	1.32	0.74			0.78		
ATT	AT01	2.59	1.51	0.81	0.80	0.58	0.835	0.84	0.64
	AT02	2.44	1.44	0.77			0.835		
	AT03	3.07	1.64	0.70			0.723		

Compared to the exploratory estimates in the last section, the Social Influence still did not report the minimum requirements for reliability. In addition, the Intention to Use and the Reported Use showed a non-acceptable AVE a non-acceptable AVE. the USE reported low factor loadings on all items.

Discriminant validity performed well as seen in Table 75 below, the Social Influence and Intention to Use may need a good review before replicating this study.

Table 75 - Discriminant Validity - Confirmatory Model - ML

Construct	USE	PE	EE	SI	ENJ	MA	IN	ATT
USE	0.24							
PE	0.01	0.47						
EE	0.00	0.45	0.60					
SI	0.13	0.19	0.14	**0.31**				
ENJ	0.08	0.17	0.15	0.59	0.60			
MA	0.00	0.17	0.08	0.15	0.18	0.58		
IN	0.06	0.33	0.27	0.32	0.46	0.10	**0.50**	
ATT	0.02	0.16	0.22	0.53	0.43	0.14	0.51	0.64

10.6 ALTERNATIVE APPROACHES

In this part, the researcher uses a method of rescaling the data within the statistical software "R" the package "aspect" where a correlation matrix will be created and used in Mplus again with the ML estimator to re-test the final model resulting from part one and to re-validate the relations implied.

The researcher thought of this approach as a way to use the ML full information estimator with categorical data that cannot be done in a direct approach in Mplus. The main idea is to apply a rescaling approach stemming from the Gifi-family; this optimal scaling procedure transforms the observed variables (categories) in terms of quantification that can be further analyzed. In the case at hand, the correlation matrix will be used as an input for Mplus and the full information estimator ML can be employed.

As this approach is used without replacing any missing values, only cases with complete data are admissible. So Dataset one was joined with dataset two to create a comprehensive dataset that includes 850 cases.

10.6.1 TESTING THE STRUCTURAL MODEL

The model fit indices yielded quite similar results to what was reported in the exploratory and confirmatory phases while using the ML estimator. Below is Table 76 showing these results side by side:

Table 76 - Structural Model - Fit Indices - Ml Using The "Aspect" Package

Fit index	Recommended Value	Exploratory	Confirmatory	Using "aspect"
CFI (Comparative Fit Index)	≥0.90	0.884	0.876	0.886
TLI (Tucker-Lewis Index)	≥0.90	0.874	0.865	0.876
RMSEA	≤0.08	0.044	0.050	0.046
SRMR	≤0.08	0.055	0.063	0.056

The relations proposed in the exploratory model development phase have been tested here once again, all the relations reported significant measures except for Effort Expectancy on the Intention to Use". Below is Table 77 showing these relations next to the results of the confirmatory and exploratory phases.

Table 77 - Model Relations - Ml Using the "Aspect" Package

No	Relation	ML - Exploratory		ML - Confirmatory		ML - Using "aspect"	
		Path Coefficient	Critical ratio	Path Coefficient	Critical ratio	Path Coefficient	Critical ratio
1	Effort Expectancy on Performance Expectancy - "+"	0.772	24.566	0.699	21.483	0.762	31.119
2	Performance Expectancy On the Intention to Use - "+"	0.384	4.295	0.268	4.115	0.242	3.982
3	Effort Expectancy on the Intention to Use - "-"	**-0.123**	**-1.23**	**0.014**	**0.186**	**-0.109**	**-1.385**
4	Social Influence on the Intention to Use - "+"	0.47	5.884	0.357	4.885	0.566	9.04
5	Attitude on Intention to Use - "+"	0.386	6.079	0.385	6.001	0.315	6.938
6	The Perceived Enjoyment on the Attitude - "+"	0.521	10.754	0.657	16.45	0.605	16.778
7	The Mobile Affinity on the Attitude - "+"	0.244	4.815	**0.085**	**1.819**	0.15	3.657
8	The Intention to Use on the Reported Use - "+"	0.261	4.819	0.252	5.266	-0.3	-7.552

It is interesting to notice that there was no significant difference between the confirmatory models; the data presentation played a minor role here especially when using the ML estimator. It is worth mentioning that the rescaling done here is not as radical as the dichotomous rescaling done in earlier chapters.

10.7 MODERATOR EFFECT

Three moderators will be examined in this part: age, gender and experience. A multi- group analysis will be conducted using Mplus; the complete dataset will be used for this analysis to allow for big enough groups.

The estimator WLSMV along with the categorical data presentation will be applied along these tests, standardized results will be chosen here as well.

The model developed in the exploratory phase and successfully tested in the confirmatory phase will serve as a base model to sense any changes due to the moderator effects.

As all the relations proposed in the exploratory model were supported in the confirmatory one, any non-supported relation within the group analyses will mark the sensitivity of the model to one of the moderators.

Negative coefficients in the relation “the Intention to Use on the Reported Use” is a positive one in nature, but expected to be negative due to reverse scaling.

10.7.1 EXPERIENCE

The experience has been capturing users’ subscription to the mobile internet services, it is not a default setting by the operator, as you have to ask for it specifically or go through a registration process over your mobile phone or a computer.

The variable GA03 captures this experience, and it will be selected as a grouping variable for the analysis. This grouping resulted in 453 users and 598 non-users, 44 cases were not included in the grouping as they contain missing values.

The overall model fitting resulted in good measures, they are listed in Table 78 below. The WRMR reports an acceptable value, but since it is directly related to the sample size, it is the recommendation of Muthén and Muthén to ignore it if all other fit indices attain satisfying values.

Table 78 - Experience Effect - Baseline Model - Fit Indices

Fit index	Recommended Value	Model Results
CFI (Comparative Fit Index)	≥0.90	0.929
TLI (Tucker-Lewis Index)	≥0.90	0.954
RMSEA	≤0.08	0.059
WRMR	Close to 1	1.916

Table 79 below shows the relations and their critical ratios; un-supported paths are presented in bold fonts:

Table 79 - Experience Effect

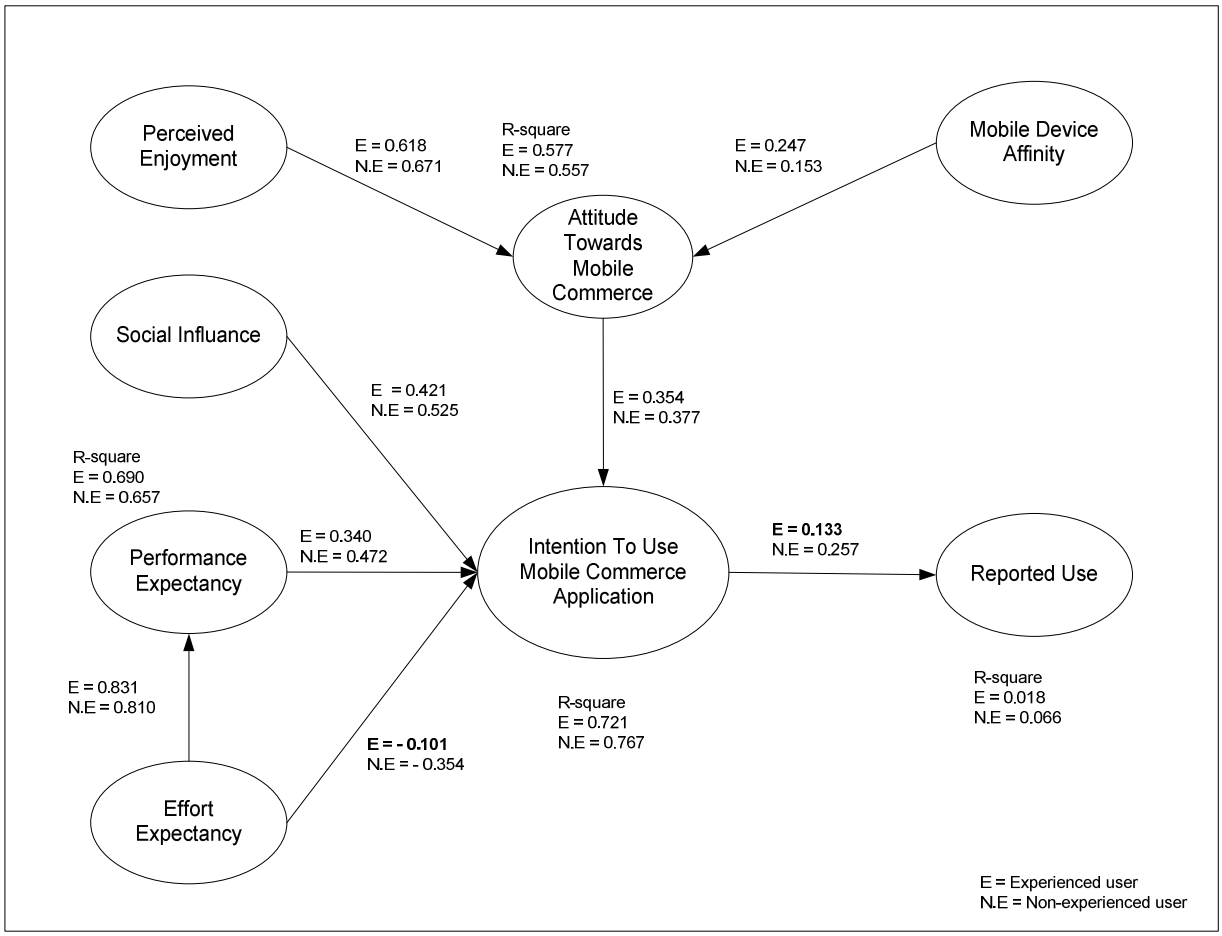
No	Relation	Experienced (n=453)		None-experienced (n=598)	
		Path Coefficient	Critical ratio	Path Coefficient	Critical ratio
1	Effort Expectancy on Performance Expectancy - "+"	0.831	28.299	0.81	29.337
2	Performance Expectancy On the Intention to Use - "+"	0.34	2.702	0.472	4.296
3	Effort Expectancy on the Intention to Use - "-"	**-0.101**	**-0.669**	-0.354	-2.739
4	Social Influence on the Intention to Use - "+"	0.421	4.693	0.525	7.493
5	Attitude on Intention to Use - "+"	0.354	5.394	0.377	7.561
6	The Perceived Enjoyment on the Attitude - "+"	0.618	13.78	0.671	20.158
7	The Mobile Affinity on the Attitude - "+"	0.247	4.754	0.153	3.409
8	The Intention to Use on the Reported Use - "+"	**0.133**	**1.943**	0.257	4.364

The non-experienced group supported all the relations contradictory to what was originally proposed and what was confirmed; this group also reported more significant values on all relations compared to the experienced group that failed to report significant values on "the Intention to Use on the Reported Use" and "the Effort Expectancy on the Intention to Use" relations.

However, both groups have the Perceived Enjoyment as the major influential factor of the Attitude followed by the Mobile Affinity. It is worth mentioning that the non-experienced group is relatively more affected by the enjoyment factor in comparison to the experienced group.

Below in Figure 32 is an illustration showing the structural model and the factor loadings for both the experienced group and non-experienced one.

Figure 32 - Moderator Effect - Experience



10.7.2 GENDER

As argued and discussed by various authors (Venkatesh and Morris 2000; Venkatesh, Morris et al. 2003; DeBaillon and Rockwell 2005; Carlsson, Carlsson et al. 2006; Economides and

Grousopoulou 2008; Sangjo, Song et al. 2008) gender plays a significant role in the adoption of new technologies and services.

The gender distribution in the whole sample as well as in both datasets used in the exploratory and the confirmatory phases is very symmetric with almost the same number of females and males. This allowed for big samples for both groups; where the female group consisted of 533 cases and the male group consisted of 532 cases. A number of missing cases were present in this grouping variable; these amounted to 30 cases.

The overall model fitting resulted in acceptable measures, they are listed in Table 80 and as argued above the WRMR can be ignored.

Table 80 - Gender Effect - Baseline Model - Fit Indices

Fit index	Recommended Value	Model Results
CFI (Comparative Fit Index)	≥0.90	0.917
TLI (Tucker-Lewis Index)	≥0.90	0.953
RMSEA	≤0.08	0.063
WRMR	Close to 1	1.996

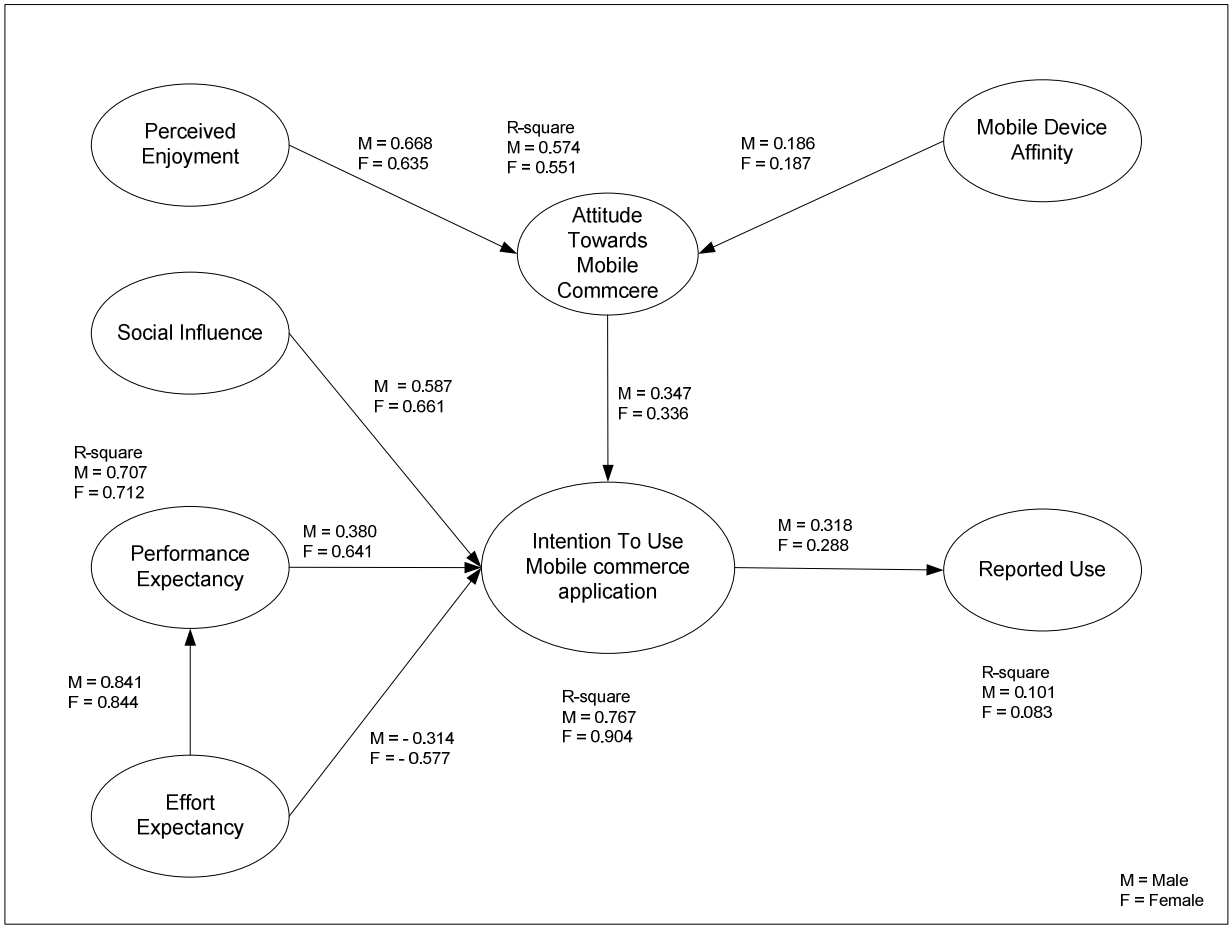
Table 81 shows the relations and their critical ratios for both, the male and the female groups. All of the relations were supported within both groups; the females and the males. The females perceived in the Social Influence a higher influential factor on the Intention to Use than the males did where the males saw in the in the Perceived Enjoyment a more influential factor on the Attitude than females did. Both males and females have a similar attitude toward Mobile Affinity.

Table 81 - Gender Effect

No	Relation	Male (n=532)		Female (n=533)	
		Path coefficient	Critical ratio	Path coefficient	Critical ratio
1	Effort Expectancy on Performance Expectancy - "+"	0.841	32.321	0.844	30.531
2	Performance Expectancy On the Intention to Use - "+"	0.38	2.727	0.641	4.381
3	Effort Expectancy on the Intention to Use - "-"	-0.314	-1.837	-0.577	-3.369
4	Social Influence on the Intention to Use - "+"	0.578	5.695	0.661	8.961
5	Attitude on Intention to Use - "+"	0.347	5.052	0.336	6.556
6	The Perceived Enjoyment on the Attitude - "+"	0.668	18.417	0.635	16.41
7	The Mobile Affinity on the Attitude - "+"	0.186	3.85	0.187	3.839
8	The Intention to Use on the Reported Use - "+"	0.318	5.555	0.288	4.769

In Figure 33, the relations and their factor loadings are shown, also the R square for the latent variables, most of the results were similar for the female and the male group except for the Intention to Use Mobile Commerce Applications where the females reported an R square of almost 90% and the males of 77%.

Figure 33 - Moderator Effect - Gender



10.7.3 AGE

The age distribution in the sample is by no mean close to normal. It is concentrated between 19 and 22 years due to the fact that 75% of the sample are university students.

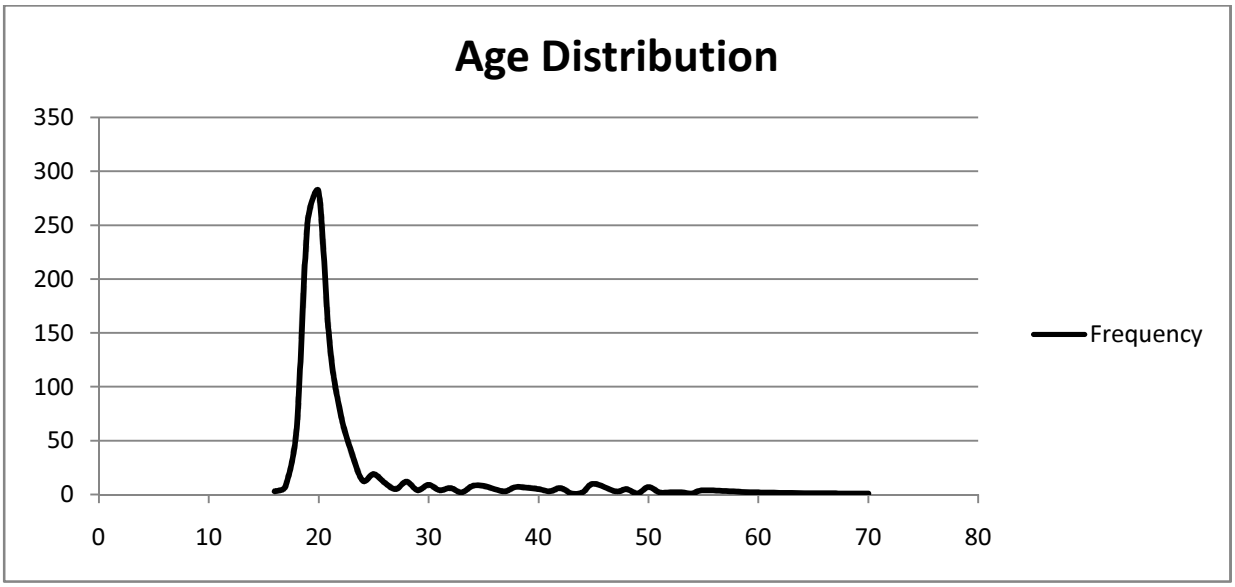
The researcher decided to split by age in two groups, the first one is below 25 years old and the second one 25 years and above. This approach creates one small group consisting of 161 cases and another relatively big group consisting of 873 cases. This cutting has been re-coded in the dataset under the name Age01; where "0" represents the younger group and "1" represents the older group. Missing values were present in the grouping variable; these amounted to 61 cases.

This cut-off point suggested above resulted in a small "old" group, the size of the group is not enough to conduct the test as the parameters exceeded the sample size. Any other

lower cut-off point is not meaningful for any age analysis. So in this research, age as a moderator effect could not be evaluated.

An overview of the age distribution can be found in Figure 34 below.

Figure 34 - Age Distribution



PART FIVE:

CONCLUSIONS

THIS PART PRESENTS THE CONCLUSION AND FINDINGS OF THE STUDY ALONG WITH INDUSTRY IMPLICATIONS, RESEARCH LIMITATIONS AND FUTURE IMPLICATIONS.

11 CONCLUSIONS

The research conducted in this dissertation covers many aspects of the Mobile Commerce industry and players. It also gave an insight into this dynamic field and the ever-changing value chains and business models.

A structural equation model was developed based on a literature review of the information systems adoption theories and the latest research in the Mobile Commerce adoption field. The Technology Acceptance Model and its many variations was the core of the research model, the “Intention to Adopt” and “Attitude towards the Mobile Commerce” were the center of this model.

First hand data was collected using a two pages questionnaire; the data was collected from nine different locations as 1095 respondents filled in the questionnaire; 31 cases were rejected which left 1064 cases for the analysis. The students dominated that sample; more than 75% of the respondents were college students due to the fact that the biggest three collection locations were universities.

A two-stage research approach was implemented: an exploratory and latter a confirmatory one. The data was randomly split into two halves, where the first one was used for exploratory phase and the second half was used for the confirmatory phase.

Based on the hypothesized model testing and literature guided approach, the exploratory model was developed; multiple combinations of data presentations (binary, interval and scale) and estimators (maximum likelihood and weighted least squares) were used in the estimation process to indicate any possible variations in the results while using different estimators and data formats.

For administrating the data and the simple statistical analyses the statistical package SPSS was used. The structural equation models were specified with Mplus. This powerful software provided a flexible platform and interface for model testing, development and multi-group analysis.

11.1 DISCUSSION

The sample distribution & characteristics

The sample does not fully represent the Palestinian market as the average age of the respondents is 22.5 years where more than 75% are students and two thirds live in urban areas. This does not reflect the demographic distribution of the Palestinian population(PCBS 2010) in the West Bank where this study was conducted.

One fourth of the respondents never used a mobile service, where the average number of services used was 2.65 with a clear domination and preference for entertainment services. The mobile fleet used by the sample is a "high end" one; most of the devices had a Bluetooth, color screen and a camera, where one third had a Wi-Fi. This reflects the fact that high end devices are at the disposal of the users paving the ground for uptaking new Mobile Commerce applications (Saidi 2010).

The users who reported that they consumed mobile services, spend twice as much money on their monthly bills, but still made twice as many calls. It was clear that more conventional mobile usage is naturally influencing the overall bill, but it also shows the higher tendency to use non-traditional mobile services and applications. Those "Users" also showed a remarkable higher awareness of their mobile device capabilities besides the Mobile Commerce and Electronic Commerce in general compared to the "Non- users".

Data presentation

While testing the initially hypothesized model several runs with different combinations of estimators and data presentations have been conducted. Rescaling the data into dichotomies scale has reduced the number of thresholds and hence the calculation time, but still suffered from a significant loss of information. It is due to the wide scale used in this study (6-point Likert scale). To account for all possible scale presentations; interval, binary and categorical scales were used in Mplus to estimate the model parameters. Only the binary presentation reported significant differences from the other two variations. As discussed, this is due to the loss of information by downscaling the Likert scale into binary. If this rescaling were done on the basis of a 4-points scale it might have resulted in a better

performance (Dickinger 2007). The estimator choice was also an issue in this study, both the Maximum Likelihood and the Weighted Least Squares were used with the different combinations of data presentation to examine the model in different ways.

Model testing and findings

The researcher found that the strongest indicator of the Intention to Use was the Attitude, the second strongest indicator -which also passed all the empirical tests-, is found to be the Performance Expectancy. The Effort Expectancy, Social Influence, Perceived Price of Service and the Perceived Enjoyment have some an influence on the Intention to Use. The Strongest indicator on the Attitude in the whole model was the Perceived Enjoyment where the second strongest determinant of Attitude was found to be the Mobile Affinity.

When the exploratory model was developed, results from the initial model testing and relevant literature were taken into consideration, all of the relations were validated again in the confirmatory run; it was found that the most significant determinant in the model was the impact of Effort Expectancy on the Performance Expectancy followed by the Perceived Enjoyment on the Attitude.

When using the WLSMV estimator the results were more satisfactory than using the ML estimator; this is a typical case when using peaked data, which is the case at hand. However, no significant differences where found when using both estimators.

The group testing involved three different moderators; gender, experience and age, the last one could not be tested as most of the respondents were between 18 and 22 leaving no room for creating two groups where such comparison and test can take place.

Gender

The gender and experience attributes could differentiate the sample into two big groups; as for gender, it was found that female and male groups supported all the relations suggested in the exploratory model; however, the female group showed higher significance of the "Social Influence" and the "Performance expectancy" on the "Intention to Use" than the male group. The females expect more from the Mobile Commerce applications in terms of social status and performance boost.

Experience

The non-experienced group supported all the relations; this group also reported more significant values on all relations compared to the experienced group which failed to report significant values on “the Intention to Use on the Reported Use” and “ the Effort Expectancy on the Intention to Use” relations. Both groups have the Perceived Enjoyment as the major influential factor of the Attitude followed by the Mobile Affinity. It is worth mentioning that the non-experienced group is relatively more affected by the enjoyment factor in comparison to the experienced group. In addition, the experienced group is more realistic in their expectations from the M-Commerce applications than the non- experienced users.

11.2 INDUSTRY IMPLICATIONS

This study gives a clear insight into the attitude and the intention of the students and the young population in the Palestinian market in specific and the emerging markets in general. Based on the analysis it was clear that the enjoyment and the Social Influence are the key players in adopting new Mobile Commerce services; any future product or service development should consider these two factors.

The current mobile devices at the disposal of the users are of high caliber allowing the introduction of more sophisticated Mobile Commerce applications (Saidi 2010). However, the infrastructure to support the use of the applications is not advanced (detailed maps, comprehensive and updated databases) so only personal applications (i.e. entertainment or transactional services) or business-to-business applications can see success at the time being.

The experienced users have a low Performance Expectancy influence on their Intention to Use the mobile services. These people do not expect much of the system anymore mostly due to unpleasant or bad experiences. This is contrary to the non-experienced users who are the majority in the case in hand, and see in the potential use of mobile services a relatively big boost in their performance and consider this when forming the intention to adopt these services.

In general, the awareness is still low. Classical wired electronic commerce transactions are not in par with the rest of the world. So capitalizing on classical wired electronic commerce awareness is not a good strategy to promote Mobile Commerce uptake. Concentrating and developing pure Mobile Commerce applications is the way to increase usage; it may also have an indirect effect on the uptake of classical wired electronic commerce. Besides that, a framework to regulate the mobile payments is non-existent. This is very necessary for the introduction of new services and companies; such a framework is best created by cooperation between the private and public sectors.

It is clear for the researcher that many of the technological hurdles facing the service providers in Palestine have to do with the spectrum allocation regulated by the Joint Economic Committee (Palestinians and Israelis) as agreed in the Paris protocol of 1994. The current allocation is dating back to 1998, which gives the Palestinian operators a very narrow span of spectrum to serve their growing consumer base, it is almost impossible to provide value added services with the current spectrum allocation. During summer 2009 the JEC met again regarding the reallocation of the spectrum; the meeting ended without concrete outcomes. Nevertheless, below are some points that a service provider might want to consider when developing a marketing strategy for added value services as soon as the technological infrastructure permits:

Security and trust: It is unexplored in this research and it is expected to be a hurdle to adoption of M-Commerce as mobile users are used to electronic transactions (Kim, Ferrin et al. 2008).

Cash is the main medium of exchange in Palestine (PMA 2010). Credit and online payments are growing slowly as people still prefer using cash. Any mobile payment infrastructure might face serious hurdles for mass adoption.

The current set of services offered by the Palestinian mobile operators is limited to 2G SMS value added services and applications. Besides classical voice and text, if the market is to move forward with the Mobile Commerce offerings, the following points may be considered:

As the mobile adoption rates are hovering around 50%, there is room for additional revenue through new voice and text consumers, but the operators should start offering a more

complex array of value added services that will be the future revenue stream for the providers.

Attitude and the intention are key in stimulating future adoption of Mobile Commerce, thus emphasizing the enjoyment, perceived usefulness and ease of use are key elements in campaigning for new services.

Low cost - one stop shop strategy for value added services. Through this research, the perceived price of services was found to be high compared to the regular voice and text services.

Operator revenues will be made from the uptake of data traffic; reliable data traffic requires investment in the infrastructure to support such uptake.

Cooperation between the private sector and the regulatory bodies to establish a set of rules and guidelines for Mobile Commerce is important.

11.3 RESEARCH LIMITATIONS

As the majority of the respondents were college students, generalization to all consumers is not applicable; in spite of this the results are very attractive for the mobile operators as more than 42% of the Palestinian populations is less than 15 years old (PCBS 2009). A more comprehensive sample covering a wider age range is recommended for being able to generalize the results.

Regarding the research tool, this study showed some deficiencies in the constructs related to the Social Influence and to the Perceived Price of Service, these should be reevaluated in future research; reevaluation mainly may involve rephrasing of questions and reconsidering the Likert scale range (6-point) used. It was found to be too wide for the respondents, future research should consider a 4-point scale which proved to be more practical (Dickinger 2007).

New elements may be considered in developing or modifying the model proposed in this research. Security concerns, trust and innovativeness may be among these elements to include in future research.

12 APPENDIX

THIS PART CONTAINS SEVEN APPENDIXES; THESE INCLUDE THE QUESTIONNAIRE IN ARABIC AND MPLUS CODE FOR THE VARIOUS TESTS MADE IN THIS RESEARCH.

TO REPLICATE THE CALCULATIONS THROUGH MPLUS, PLEASE CONTACT THE RESEARCHER AT: bghannam@gmail.com AND HE WILL SEND YOU THE INPUT DATA TO RUN THE TESTS AGAIN.

12.1 APPENDIX 1: THE QUESTIONER

1 هل لديك هاتف "خلوي" ؟	**(اذا كان جوابك "لا" الرجاء عدم اكمال الاستبيان)**	نعم ☐ لا ☐
2 منذ متى تمتلك الجهاز الحالي ؟		اشهر _____ سنوات _____
3 كم جهاز خلوي لديك ؟	المقصود " لجهاز خلوي" هنا هو جهاز له رقم"SIM " مشترك مع شركة اتصالات	1 ☐ 2 ☐ 3 ☐ اكثر_____
4 ما هي الشركات المرتبط معها ؟		جوال ☐ بلفون ☐ سيلكوم ☐ اورنج ☐ ميرر ☐
5 ما نوع الجهاز الذي تمتلكه؟		نوكيا ☐ ال جي ☐ موتورولا ☐ سامسونج ☐ سوني اريكسون ☐ غيرها : _____
6 هل يحتوي الجهاز الخلوي على اي من التالية ؟		شاشة ملونة ☐ كاميرا ☐ واي فاي ☐ بلوتوث ☐
7 كم مكالمة ترسل(تتصل) في اليوم تقريبا؟		مكالمة _____
8 كم مكالمة تستقبل في اليوم تقريبا ؟		مكالمة _____
9 كم معدل فاتورتك الشهرية تقريبا ؟		شيكل: _____
10 كم رسالة قصيرة "SMS" ترسل يوميا بالمعدل؟		في اليوم _____
11 كم رسالة "MMS" ترسل شهريا ؟		في الشهر _____
12 هل تعرف عن مختلف خدمات شبكة الاتصالات الخليوية ؟		نعم ☐ لا ☐ لا ادري ☐
13 هل بامكان هاتفك الخلوي ان يؤدي خدمات الكترونية عبر الشبكة؟(مثل خدمة الانترنت لخليوية او غيرها)		نعم ☐ لا ☐ لا ادري ☐
14 هل سبق واشتركت بخدمة الانترنت الخليوية عبر جهازك ؟		نعم ☐ لا ☐ لا ادري ☐
15 اذا كان جوابك نعم فهل ما زلت مشتركا ؟		نعم ☐ لا ☐ لا ادري ☐
16 هل سبق ان بعت او اشتريت منتوج ما عبر شبكة الانترنت ؟		نعم ☐ لا ☐ لا ادري ☐
17 هل استخدمت احدى الخدمات التالية		
بنكك في جوالك ☐	رنلي (تحميل رنات) ☐	الفاتورة عبر البريد الإلكتروني ☐ البريد الصوتي VMS ☐
الأرقام المختصرة ☐	انترنت ☐	الفاتورة عبر SMS ☐ الخدمات الترفيهية (مثل صور شعار) ☐
Missed Call notification ☐	خدمة هات و خذ ☐	التسديد الالي ☐ الخدمات الترفيهية (مثل :الكاريكاتير،الابراج،اخبار الفنانين ☐
خدمات رياضية ☐	خدمات الأخبار العاجلة ☐	الخدمات الدينية ☐

ضع دائرة حول الرقم الذي يعبر عن قناعتك :	اوافق بشدة					لا اوافق بشدة
18 هل تعتقد ان خدمات الهاتف الخليوي مفيدة في حياتك اليومية ؟	1	2	3	4	5	6
19 ان استخدام خدمات الهاتف الخليوي مرنة حيث يمكن استعمالها في اي زمان و مكان؟	1	2	3	4	5	6
20 ان استعمال خدمات الهاتف الخليوي توفر الوقت والجهد في اداء مهامي؟	1	2	3	4	5	6
21 ان استعمال خدمات الهاتف الخليوي تزيد من انتاجيتك؟	1	2	3	4	5	6
22 ان تعلم استعمال خدمات الهاتف الخليوي ستكون سهلة بالنسبة لي؟	1	2	3	4	5	6
23 هل تستطيع التعلم بسهولة كيفية توظيف واستعمال تقنيات جديدة ؟	1	2	3	4	5	6
24 انه من السهل علي تسخير خدمات الهاتف الخليوي لخدمتي ؟	1	2	3	4	5	6
25 انا على "الموضة" في استعمال خدمات الهاتف الخليوي؟	1	2	3	4	5	6
26 يعتقد اصدقائي وعائلتي انه يتوجب علي ان استعمل خدمات الهاتف الخليوي ؟	1	2	3	4	5	6
27 انا من بين الاوائل الذين يستعملون التقنيات الحديثة ؟	1	2	3	4	5	6
28 في المستقبل المنظور سوف استعمل خدمات شبكة الهاتف الخليوي	1	2	3	4	5	6
29 لو قدر الي الوصو ل الى خدمات الهاتف الخليوي فأنا انوي استعمالها؟	1	2	3	4	5	6
30 اريد ان يكون جهازي الخليوي من احدث الموديلات	1	2	3	4	5	6
31 اريد تجربة احدث التقنيات الخليوية ؟	1	2	3	4	5	6
32 افضل شراء جهاز خليوي متطور و غالي الثمن على شراء جهاز بسيط رخيص الثمن	1	2	3	4	5	6
33 ليست التكلفة "ثمن وقت الاتصال ، الاشتراك والخدمات" عائقا في استعمالي الخدمات الخليوية؟	1	2	3	4	5	6
34 تكلفة استعمال خدمات شبكة الخليوي عالية	1	2	3	4	5	6
35 تتوفر لدي الامكانية المادية "ثمن وقت الاتصال ، الاشتراك والخدمات" لاستعمال الخدمات الخليوية ؟	1	2	3	4	5	6
36 استمتع في استعمال الخدمات الخليوية ؟	1	2	3	4	5	6
37 لا اشعر بمرور الوقت عند استعمال الخدمات الخليوية كتصفح الانترنت على الهاتف الخليوي ؟	1	2	3	4	5	6
38 استمتع بالتفاعل مع خدمات شبكة الهاتف الخليوي	1	2	3	4	5	6
39 اذا كان جهازك الخليوي خارج نطاق التغطية ، اشعر اني مفصول عن العالم ؟	1	2	3	4	5	6
40 اشعر بالضياع من دون جهاز الخليوي ؟	1	2	3	4	5	6
41 لا اذهب الى اي مكان من دون الهاتف الخليوي ؟	1	2	3	4	5	6
42 يمكنني ان ابقى بضعة ايام من دون هاتف خليوي ؟	1	2	3	4	5	6

الجنس ذكر ☐ انثى ☐ || **العمر** سنوات _____ || **مكان السكن** مدينة ☐ قرية ☐ مخيم ☐

هل لديك تلفون خط ارضي؟ **في البيت** نعم ☐ لا ☐ **اذا كنت تعمل : في العمل** نعم ☐ لا ☐

حدد طبيعة عملك : رجل اعمال ☐ تاجر ☐ موظف ☐ طالب ☐ اخرى ☐

12.2 APPENDIX 2: MPLUS INPUT CODE - ORIGINAL MODEL TESTING - WLSMV WITH CATEGORICAL DATA.

```
Mplus VERSION 5.2
MUTHEN & MUTHEN
05/30/2010   8:18 PM

INPUT INSTRUCTIONS

       TITLE: Original Model Testing - Structure - WLS - Part
one
      DATA: FILE IS Sample1of2-6cat-FOUC.dat;



       VARIABLE: NAMES ARE
                  CaseID Location
                  MDS01 MDS02 MDS03 MDS04 MDS05 MDS06 MDS07
                  MDS08 MDS09 MDS10 MDS11 MDS12 MDS13 MDS14
                  MDS15 MDS16 MDS17 MDS18
                  FOU01 FOU02 FOU03 FOU04 FOU05
                  GA01 GA02 GA03 GA04 GA05
                  SU01 SU02 SU03 SU04 SU05 SU06 SU07 SU08
                  SU09 SU10 SU11 SU12 SU13 SU14 SU15 SUALL
                  PU01 PU02 PU03 PU04
                  PEU01 PEU02 PEU03
                  SI01 SI02
                  IN01 IN02 IN03
                  AT01 AT02 AT03
                  FS01 FS02 FS02R FS03
                  PE01 PE02 PE03
                  MA01 MA02 MA03 MA04 MA04R
                  DEM01 DEM02 DEM03 DEM04 DEM05 DEM06
                  FOU01C FOU02C FOU03C FOU04C;


                 USEVARIABLES ARE

                 su01-su15
                 FOU01C FOU02C FOU03C  FOU04C
                 PU01 PU02 PU03 PU04
                 PEU01 PEU02 PEU03
```

```
SI01 SI02
IN01 IN02 IN03
AT01 AT02 AT03
FS01 FS02R FS03
PE01 PE02 PE03
MA01 MA02 MA03 MA04R;

CATEGORICAL ARE
su01-su15
FOU01C FOU02C FOU03C  FOU04C
PU01 PU02 PU03 PU04
PEU01 PEU02 PEU03
SI01 SI02
IN01 IN02 IN03
AT01 AT02 AT03
FS01 FS02R FS03
PE01 PE02 PE03
MA01 MA02 MA03 MA04R;


MISSING ARE ALL (-1);


 ANALYSIS:
! TYPE IS MISSING;
 ESTIMATOR is wlsmv;
 ITERATIONS = 2000;
 CONVERGENCE = 0.000050;
 H1ITERATIONS = 1000;
 H1CONVERGENCE = 0.000100;

 MODEL:
 use by su01-su15;
 PE  by  PU01 PU02 PU03 PU04 ;
 EE  by PEU01 PEU02  PEU03 ;
 SI  by SI01 SI02;

 FS  by FS01 FS02R FS03 ;
 FOU by FOU01C FOU02C FOU03C  FOU04C ;
 ENJ by PE01 PE02 PE03;
 MA by  MA01 MA02 MA03 MA04R ;

 IN by IN01 IN02  IN03;
 ATT by AT01 AT02  AT03;
```

```
IN on PE EE SI FS FOU ENJ MA ATT;
ATT on FS FOU ENJ MA;
use on in;

Output:  STANDARDIZED SAMPSTAT TECH4 ;
```

12.3 APPENDIX 3 : MPLUS INPUT CODE - EXPLORATORY MODEL TESTING - WLSMV

```
Mplus VERSION 5.2
MUTHEN & MUTHEN
05/20/2010   5:11 PM

INPUT INSTRUCTIONS

       TITLE: Exploratory Model

       DATA: FILE IS Sample1of2-6cat-FOUC-use.dat;
      !FILE IS Sample2of2-6cat-FOUC-use.dat;

        VARIABLE: NAMES ARE
                    CaseID Location
                    MDS01 MDS02 MDS03 MDS04 MDS05 MDS06 MDS07
                    MDS08 MDS09 MDS10 MDS11 MDS12 MDS13 MDS14
                    MDS15 MDS16 MDS17 MDS18
                    FOU01 FOU02 FOU03 FOU04 FOU05
                    GA01 GA02 GA03 GA04 GA05
                    SU01 SU02 SU03 SU04 SU05 SU06 SU07 SU08
                    SU09 SU10 SU11 SU12 SU13 SU14 SU15 SUALL
                    PU01 PU02 PU03 PU04
                    PEU01 PEU02 PEU03
                    SI01 SI02
                    IN01 IN02 IN03
                    AT01 AT02 AT03
                    FS01 FS02 FS02R FS03
                    PE01 PE02 PE03
                    MA01 MA02 MA03 MA04 MA04R
                    DEM01 DEM02 DEM03 DEM04 DEM05 DEM06
                    FOU01C FOU02C FOU03C FOU04C;


                  USEVARIABLES ARE
                  SU01-SU15
                  PU01 PU02 PU03 PU04
                  PEU01 PEU02 PEU03
                  SI01 SI02
                  IN01 IN02 IN03
                  AT01 AT02 AT03
```

```
PE01 PE02 PE03
MA01 MA02 MA03;

MISSING ARE ALL (-1);

Categorical are
SU01-SU15
PU01 PU02 PU03 PU04
PEU01 PEU02 PEU03
SI01 SI02
IN01 IN02 IN03
AT01 AT02 AT03
PE01 PE02 PE03
MA01 MA02 MA03;


ANALYSIS:
!TYPE IS MISSING;
!ESTIMATOR is ML;
!ITERATIONS = 2000;
!CONVERGENCE = 0.000050;
!H1ITERATIONS = 1000;
!H1CONVERGENCE = 0.000100;

MODEL:
USE by SU01-SU15;
PE  by PU01-PU04 ;
EE  by PEU01 PEU02  PEU03 ;
SI  by SI01 SI02;
ENJ by PE01 PE02 PE03;
MA  by MA01 MA02 MA03;

IN  by IN01 IN02  IN03;
ATT by AT01 AT02  AT03;

PE  ON  EE  ;
IN on   PE EE SI  ATT  ;
ATT ON    ENJ MA;
USE on IN;
Output:  STDYX SAMPSTAT TECH4;
```

12.4 APPENDIX 4 : MPLUS INPUT CODE - CONFIRMATORY MODEL TESTING - WLSMV

```
Mplus VERSION 5.2
MUTHEN & MUTHEN
05/21/2010   4:55 PM

INPUT INSTRUCTIONS

       TITLE: Confirmatory  Model

       DATA: FILE IS Sample2of2-6cat-FOUC-use.dat;

        VARIABLE: NAMES ARE
                    CaseID Location
                    MDS01 MDS02 MDS03 MDS04 MDS05 MDS06 MDS07
                    MDS08 MDS09 MDS10 MDS11 MDS12 MDS13 MDS14
                    MDS15 MDS16 MDS17 MDS18
                    FOU01 FOU02 FOU03 FOU04 FOU05
                    GA01 GA02 GA03 GA04 GA05
                    SU01 SU02 SU03 SU04 SU05 SU06 SU07 SU08
                    SU09 SU10 SU11 SU12 SU13 SU14 SU15 SUALL
                    PU01 PU02 PU03 PU04
                    PEU01 PEU02 PEU03
                    SI01 SI02
                    IN01 IN02 IN03
                    AT01 AT02 AT03
                    FS01 FS02 FS02R FS03
                    PE01 PE02 PE03
                    MA01 MA02 MA03 MA04 MA04R
                    DEM01 DEM02 DEM03 DEM04 DEM05 DEM06
                    FOU01C FOU02C FOU03C FOU04C;


                  USEVARIABLES ARE
                  SU01-SU15
                  PU01 PU02 PU03 PU04
                  PEU01 PEU02 PEU03
                  SI01 SI02
                  IN01 IN02 IN03
                  AT01 AT02 AT03
                  PE01 PE02 PE03
```

```
MA01 MA02 MA03;

MISSING ARE ALL (-1);

categorical are
SU01-SU15
PU01 PU02 PU03 PU04
PEU01 PEU02 PEU03
SI01 SI02
IN01 IN02 IN03
AT01 AT02 AT03
PE01 PE02 PE03
MA01 MA02 MA03;


ANALYSIS:
!TYPE IS MISSING;
!ESTIMATOR is ML;
!ITERATIONS = 2000;
!CONVERGENCE = 0.000050;
!H1ITERATIONS = 1000;
!H1CONVERGENCE = 0.000100;

MODEL:
USE by SU01-SU15;
PE  by PU01-PU04 ;
EE  by PEU01 PEU02  PEU03 ;
SI  by SI01 SI02;
ENJ by PE01 PE02 PE03;
MA  by MA01 MA02 MA03;

IN  by IN01 IN02  IN03;
ATT by AT01 AT02  AT03;

PE  ON  EE  ;
IN on   PE EE SI  ATT  ;
ATT ON    ENJ MA;
USE on IN;
Output:  STDYX SAMPSTAT TECH4;
```

12.5 APPENDIX 5: MPLUS INPUT CODE - THE "R" APPROACH

```
Mplus VERSION 5.2
MUTHEN & MUTHEN
05/25/2010   6:02 PM

INPUT INSTRUCTIONS

      TITLE: Using the Corelation matrix output from R
      DATA: FILE IS MobileCorr-SU.txt;
      TYPE = CORRELATION;
      NOBSERVATIONS = 850;



      VARIABLE: NAMES ARE
      SU01 SU02 SU03 SU04 SU05 SU06
      SU07 SU08 SU09 SU10 SU11 SU12
      SU13 SU14 SU15 PU01 PU02 PU03
      PU04 PEU01 PEU02 PEU03 SI01
      SI02 IN01 IN02 IN03 AT01 AT02
      AT03 PE01 PE02 PE03 MA01 MA02 MA03 ;



      USEVARIABLES ARE
      SU01 SU02 SU03 SU04 SU05 SU06
      SU07 SU08 SU09 SU10 SU11 SU12
      SU13 SU14 SU15
      PU01 PU02 PU03
      PU04 PEU01 PEU02 PEU03 SI01
      SI02 IN01 IN02 IN03 AT01 AT02
      AT03 PE01 PE02 PE03 MA01 MA02 MA03 ;


      ANALYSIS:
      !TYPE IS MISSING;
      !ESTIMATOR is GLS;
      !ITERATIONS = 2000;
      !CONVERGENCE = 0.000050;
      !H1ITERATIONS = 1000;
```

```
      !H1CONVERGENCE = 0.000100;

      MODEL:
      USE by SU01-SU15;
      PE  by PU01-PU04 ;
      EE  by PEU01 PEU02  PEU03 ;
      SI  by SI01 SI02;
      ENJ by PE01 PE02 PE03;
      MA  by MA01 MA02 MA03;
      IN  by IN01 IN02  IN03;
      ATT by AT01 AT02  AT03;

      ! Structure
    !  PE  ON  EE  ;
     ! IN on PE EE SI  ATT  ;
    !  ATT ON ENJ MA;
    !  USE on IN;
   Output:  STDYX SAMPSTAT TECH4;



INPUT READING TERMINATED NORMALLY
```

12.6 APPENDIX 6 : MPLUS INPUT CODE - THE MODERATOR EFFECTS : GENDER

```
Mplus VERSION 5.2
MUTHEN & MUTHEN
05/30/2010   5:29 PM

INPUT INSTRUCTIONS

       TITLE: Grouping - Gender

       DATA: FILE IS Sample-all.dat;

        VARIABLE: NAMES ARE
                    CaseID Location
                    MDS01 MDS02 MDS03 MDS04 MDS05 MDS06 MDS07
                    MDS08 MDS09 MDS10 MDS11 MDS12 MDS13 MDS14
                    MDS15 MDS16 MDS17 MDS18
                    FOU01 FOU02 FOU03 FOU04 FOU05
                    GA01 GA02 GA03 GA04 GA05
                    SU01 SU02 SU03 SU04 SU05 SU06 SU07 SU08
                    SU09 SU10 SU11 SU12 SU13 SU14 SU15 SUALL
                    PU01 PU02 PU03 PU04
                    PEU01 PEU02 PEU03
                    SI01 SI02
                    IN01 IN02 IN03
                    AT01 AT02 AT03
                    FS01 FS02 FS02R FS03
                    PE01 PE02 PE03
                    MA01 MA02 MA03 MA04 MA04R
                    DEM01 DEM02 DEM03 DEM04 DEM05 DEM06
                    FOU01C FOU02C FOU03C FOU04C
                    SU_EXP  SU_EXP02  AGE01;

                  USEVARIABLES ARE
                  su01-su15
                  PU01 PU02 PU03 PU04
                  PEU01 PEU02 PEU03
                  SI01 SI02
                  IN01 IN02 IN03
                  AT01 AT02 AT03
```

```
PE01 PE02 PE03
MA01 MA02 MA03                  ;

MISSING ARE ALL (-1);

categorical are
su01-su15
PU01 PU02 PU03 PU04
PEU01 PEU02 PEU03
SI01 SI02
IN01 IN02 IN03
AT01 AT02 AT03
PE01 PE02 PE03
MA01 MA02 MA03;

Grouping is DEM01 ( 1 = male 2 = female)

MODEL:


USE by su01-su15;
PE  by PU01-PU04 ;
EE  by PEU01 PEU02  PEU03 ;
SI  by SI01 SI02;
ENJ by PE01 PE02 PE03;
MA  by MA01 MA02 MA03;
IN  by IN01 IN02  IN03;
ATT by AT01 AT02  AT03;

PE  ON  EE  ;
IN on   PE EE SI  ATT  ;
ATT ON    ENJ MA;
USE on IN;

model female:

PE  ON  EE  ;
IN  ON  PE EE SI  ATT  ;
ATT ON  ENJ MA;
USE ON  IN;

Output:  STDYX TECH4;
```

12.7 APPENDIX 7: MPLUS INPUT CODE - GROUP ANYLASIS : EXPERIENCE EFFECT

```
Mplus VERSION 5.2
MUTHEN & MUTHEN
05/30/2010   5:39 PM

INPUT INSTRUCTIONS

       TITLE: Grouping - EXPERIENCE

       DATA: FILE IS Sample-all.dat;

        VARIABLE: NAMES ARE
                    CaseID Location
                    MDS01 MDS02 MDS03 MDS04 MDS05 MDS06 MDS07
                    MDS08 MDS09 MDS10 MDS11 MDS12 MDS13 MDS14
                    MDS15 MDS16 MDS17 MDS18
                    FOU01 FOU02 FOU03 FOU04 FOU05
                    GA01 GA02 GA03 GA04 GA05
                    SU01 SU02 SU03 SU04 SU05 SU06 SU07 SU08
                    SU09 SU10 SU11 SU12 SU13 SU14 SU15 SUALL
                    PU01 PU02 PU03 PU04
                    PEU01 PEU02 PEU03
                    SI01 SI02
                    IN01 IN02 IN03
                    AT01 AT02 AT03
                    FS01 FS02 FS02R FS03
                    PE01 PE02 PE03
                    MA01 MA02 MA03 MA04 MA04R
                    DEM01 DEM02 DEM03 DEM04 DEM05 DEM06
                    FOU01C FOU02C FOU03C FOU04C
                    SU_EXP  SU_EXP02  AGE01;

                  USEVARIABLES ARE
                  su01-su15
                  PU01 PU02 PU03 PU04
                  PEU01 PEU02 PEU03
                  SI01 SI02
                  IN01 IN02 IN03
                  AT01 AT02 AT03
                  PE01 PE02 PE03
```

```
MA01 MA02 MA03
;

MISSING ARE ALL (-1);

categorical are
su01-su15
 PU01 PU02 PU03 PU04
PEU01 PEU02 PEU03
SI01 SI02
IN01 IN02 IN03
AT01 AT02 AT03
PE01 PE02 PE03
MA01 MA02 MA03;


Grouping is ga03 ( 1 = Experienced 2 =
Notexperienced)

MODEL:


USE by su01-su15;
PE  by PU01-PU04 ;
EE  by PEU01 PEU02  PEU03 ;
SI  by SI01 SI02;
ENJ by PE01 PE02 PE03;
MA  by MA01 MA02 MA03;
IN  by IN01 IN02  IN03;
ATT by AT01 AT02  AT03;

PE  ON  EE  ;
IN  ON  PE EE SI  ATT  ;
ATT ON  ENJ MA;
USE ON  IN;

Model Notexperienced:

PE  ON  EE  ;
IN  ON  PE EE SI  ATT  ;
ATT ON  ENJ MA;
USE ON  IN;
Output:  STDYX SAMPSTAT TECH4;
```

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